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ANNUAL REPORT

OF THE

State Engineer and Surveyor

125884

OF THE

STATE OF NEW YORK.

For the Fiscal Year Ending September 30, 1899.

With the compliments of

Edward A. Bond

State Engineer and Surveyor.

ALBANY:
JAMES B. LYON, STATE PRINTER.
1900.

ANNUAL REPORT

OF THE

State Engineer and Surveyor

125[illegible]4

OF THE

STATE OF NEW YORK.

For the Fiscal Year Ending September 30, 1899.

TRANSMITTED TO THE LEGISLATURE JANUARY 19, 1900.

ALBANY:
JAMES B. LYON, STATE PRINTER.
1900.

STATE OF NEW YORK.

No. 39.

IN ASSEMBLY,

JANUARY 19, 1900.

ANNUAL REPORT

OF THE

State Engineer and Surveyor.

ALBANY, *January* 19, 1900.

To the Honorable the Speaker of the Assembly:

Sir:—I have the honor to transmit my annual report for the fiscal year ending September 30, 1899.

Very truly yours,
EDWARD A. BOND,
State Engineer and Surveyor.

REPORT.

ALBANY, *January* 19, 1900.

To the Honorable the Legislature of the State of New York.

I have the honor to present herewith my first annual report as State Engineer and Surveyor of New York.

The responsibilities of this Department and the magnitude of the interests which it controls, have long been recognized as making it one of the most important in the State Government.

In addition to the executive and professional duties of the office of State Engineer and Surveyor, the State Engineer is, ex-officio, the Engineer member of the following named commissions and boards from which there are referred for examination and report, many of the subjects which are to be decided by the boards.

They are:—

The Canal Board.—Controlling the construction and maintenance of canals.

The Board of Commissioners of the Land Office.—Controlling the sale and purchase of State lands, and the granting of lands under water.

The State Board of Health.—Controlling the approval of designs and manner of construction of proposed systems of sewers and all matters concerning the public health, especially those affecting contamination of streams and water supplies.

The Board of Equalization of Assessment.—Charged with the duty of equalizing assessments of State taxes among the several counties.

The Board of State Canvassers.—Charged with the duty of canvassing the returns of elections.

The Board of Quarantine Commissioners.—Having control of the Quarantine establishment of the port of New York.

The Forest Preserve Board.—Authorized to purchase and to perfect titles of land for the Forest Preserve.

The principal duty continues to be the design, construction and maintenance of the various parts and structures constituting the great canal system of the State by which communication is maintained and freight rates are regulated between the Great Lakes and tidewater. Recently added to this has been the duty of designing and constructing the first links of what is destined to be a great chain or system of improved highways extending over the whole State and bringing its people into closer touch with each other and into quicker communication with the railways and canals.

The general interest now felt by the people of the State in the subject of canal improvement as evidenced by the appointment by the Governor of a committee on Canals, and as reflected by the press of the State during the past year, have resulted in calls upon this department to furnish from its records, the plans and designs and estimates of cost for previous projects of canal improvement.

These plans varied in extent from the simple completion of what is now known as the nine million plan, and which consisted in making nine feet depth in the waterway of the canal and eight feet in its structures, and which was about half finished during the years 1897 and 1898—to a radical enlargement of the waterway and of its structures.

It remains to be decided by the Legislature and the people of the State, which of the various plans for canal improvement shall be accepted as a basis for the future policy of the State: This Department being ready in the meantime to supply such information and make such designs and estimates as may aid in reaching the wisest decision, and afterwards to give form to such conclusions as may be reached.

These various projects, which have occupied much time and attention, have necessarily been in addition to the usual making of surveys and plans for canal maintenance and the engineering direction and supervision (in concert with the Department of Public Works) of the construction of these works, the details of which will appear in the appended reports of the Division Engineers to whom they have been intrusted.

HISTORY OF CANAL.

At the present time the canal problem of the State is in its fourth stage since its origin in 1788, when Elkanah Watson proposed improving the natural channels by way of the Mohawk River to Wood Creek, and thence through Oneida Lake to the Oswego River and to Lake Ontario. This project was so far executed as to give navigation in 1796 for boats carrying sixteen tons from Schenectady westward 184 miles by the water route, or 150 miles in a direct line, to Seneca Falls on the outlet of Seneca Lake. The locks being first of wood, then of brick and finally of stône.

The second step was taken in 1808, when the Legislature directed Surveyor-General Simeon DeWitt to cause an accurate survey to be made of a route between the Hudson River and Lake Erie; the results of this survey were under consideration and discussion until 1816 when the Canal Law was passed authorizing the construction of the Erie and Champlain canals, which were begun in 1817 and completed in 1825; the section to Lake Ontario at Oswego being begun in 1825 and completed in 1828. The waterway of the Erie canal and of the Oswego canal was then 28 feet wide at bottom, 40 feet wide at surface of water whose depth was 4 feet. The locks being 90 feet long by 12 feet wide. The Champlain canal was 20 feet by 30 feet wide with 3 feet depth of water and the locks 75 feet by 10 feet.

The commercial success of this canal was so great that the third step was taken in 1835 when the enlargement of the Erie and the Oswego canals was begun and was completed in 1862, when the dimensions of the waterway were 52½ feet at the bottom and 70 feet at the surface of water, whose depth was 7 feet. The locks were 110 feet long by 18 feet wide, allowing passage of boats carrying 250 tons of freight, and on the Erie canal were built in pairs.

The fourth step was suggested in 1878 when the State Engineer in his annual report proposed a further enlargement and briefly formulated what has since been known as the "Seymour Plan" which was to "increase the depth of the canal to 8 feet by lowering the bottom in some places and raising the banks in others." This step was further advanced in 1895, when the people of the State voted nine million dollars to thus increase the depth to 9 feet in the waterway and 8 feet in the locks and aqueducts, this being now known as the Seymour-Adams plan of 1895.

CANAL IMPROVEMENT.

Chapters 79, Laws of 1895, and 794 of 1896, provided for the improvement of the State canals and apropriated nine million dollars for that purpose.

In January, 1896, preliminary surveys were commenced, and in the fall of 1895, 74 contracts were awarded as shown in Table 1. Work was begun in December, 1896, and continued until the spring of 1898 when it was suspended owing to the lack of funds. At the time of the suspension of the work 47 per cent. or 164 miles of the Erie canal had been fully deepened, although a number of the contracts had not been completed. During the summer and fall of 1898 no further work was done; but a large clerical force was employed completing the final accounts in preparation for the settlement of all contracts, as it was found that the amount appropriated for the purpose would be insufficient to finish the improvement contemplated, if the various contracts were completed.

On the 19th day of January, 1899 a resolution was passed by the Senate, requesting the State Engineer and Surveyor and the Superintendent of Public Works to furnish the Senate with full information as to the status of the improvement work at that time.

In response to such request, the following communication under date of February 7th, 1899, was addressed to the Senate, accompained by a tabulated statement which gives in detail the information desired.

OFFICE OF THE STATE ENGINEER AND SURVEYOR,
ALBANY, *February* 6, 1899.

To the Honorable the Senate:

We have the honor to submit a report upon the subject matter contained in the following resolution, passed by the Senate, January 19, 1899:

"Resolved, That the Superintendent of Public Works and the State Engineer and Surveyor be, and hereby are requested to communicate to the Senate at their earliest convenience, information that, as accurately as possible, shall be an answer to the following inquiries, viz.:

"First. The total number of contracts let for the improvement of the canals of the State, with the names of the contractors, a brief outline of the work to be performed, and the stipulated sum to be paid on each of them, in pursuance of the provisions of chapter 79, of the Laws of 1895, as amended.

"Second. Which of said contracts are yet unfulfilled, the causes of non-fulfillment, the sum already paid and the estimated sum that will be due on each contract when finished.

"Third. The estimated time required to complete each of the said contracts, in accordance with the specifications, also any other information that in the opinion of the Superintendent of Public Works and the State Engineer and Surveyor will aid in defining the present status of what is known as canal improvement, contemplated by the enactment of chapter 79 of the Laws of 1895, as amended."

We herewith submit a tabulated statement showing the total number of contracts to be 74.

Column "A" gives the names of the contractors; column "B" gives a brief outline of the work to be performed on each contract; column "C" shows the stipulated sum to be paid on each contract, based on the contractor's prices, figured on the quantity sheets exhibited at letting.

In column "D" we show the contracts that are completed, with a "star" and the incomplete contracts in this column are "underscored."

Column "E" shows the causes of non-fulfillment.

Column "F" the sum already paid, and column "G" shows the estimated sum that will be due on each contract when finished.

Column "H" shows the estimated time required to complete each of said contracts, in accordance with the specifications.

In connection with what is shown in column "H," some of the more specific reasons for the non-fulfillment of the contracts are as follows:

FIRST.—EASTERN DIVISION.

Contract No. 6.—The contractors are at fault in not pushing their work, having been warned repeatedly to do so. One season will finish the work.

SECOND.—MIDDLE DIVISION ERIE CANAL.

Contract No. 19.—This contract not completed by reason of contractors being hindered by floods which they could not control. Can be completed in one season.

Contracts Nos. 20, 21.—Could not have been completed within the specified time, had the work been prosecuted with proper speed. It was not so conducted, although the contractors were repeatedly urged to put on a larger force. Properly managed these contracts can be completed in one season.

Contracts Nos. 22, 23, 24, 25, 26, 27 and 28.—The completion of these contracts was delayed by reason of unforeseen difficulties in obtaining stone for the work. The contracts can now be completed in one season.

OSWEGO CANAL.

Contract No. 6.—Phoenix dam, completed, except a small portion of the apron. Work was stopped by reason of river rising and trouble of high water. Can be completed in a short time when the river is low.

Contracts Nos. 7, 8, 9 and 10.—Raising dams. Material on hand for the work; waited for low water in 1898 to do the work, but before that time arrived, work was suspended for lack of funds. Can be completed in one season when water is low.

Contract No. 46.—This work was let in December 1897; contractors intended to do this work during the summer of 1898, but were stopped on account of lack of funds.

THIRD.—WESTERN DIVISION.

Contract No. 2.—Contractor furnished his own spoil bank. Three hundred thousand cubic yards in narrow channel between Black Rock and Tonawanda. The material will either be wasted with a lake dredge or put in spoil bank with long-armed crane. Either manner of performing the work will be tedious, and it will take two seasons to complete it.

Contract No. 3.—Original rock cut 40 feet deep—the new cutting being 5 feet deep, calls for lifting material 45 feet, wasting it on berme bank. The earth will have to be lifted from 30 to 35 feet and will take two seasons to complete this contract.

Contract No. 5.—About 17 miles long. On this contract there are still about 15,000 cubic yards of rock to be excavated. Contract price for which is $3 per cubic yard; the earth can be dredged during the open season. It will require two seasons to complete this contract.

Contracts Nos. 6, 9, 10, 11 and 12.—These contracts are held by one contracting firm, and with the force that seems available with this party, from the best data we can get, it would look as if it would take three seasons to complete the work.

It is possible that this party would be willing to abandon two or three of the above contracts if thought advisable by the State.

Contract No. 13.—There is a high bank on this contract, on a steep side hill, underlaid with soft, porous, waterbearing shale rock, rendering it the most unsafe portion of the canal on the Western Division. A distance of 3,200 lineal feet involved. It has been recommended to protect the prism of this section of the canal by concreting the bottom and sides. The recent investigating commission suggested that the alignment at this point might be changed to good advantage. Either expedient is estimated to cost $132,883, which sum is included in the tables submitted.

However, it is believed that a small portion of this sum properly expended would render the canal reasonably safe after being deepened, on its present location.

In addition to the amount paid to the contractor, as shown by the table herewith submitted, drafts have been issued by the Superintendent of Public Works (Mr. Aldridge) in favor of the contractors on estimates of the State Engineer (Mr. Adams), as follows:

Eastern Division.—Contract No. 18, $1,566. (Draft dated November 14, 1898.)

Contract No. 23, $612. (Draft dated November 14, 1898.)

Contract No. 21, $1,107. (Draft dated November 14, 1898.)

Contract No. 28, $378. (Draft dated November 14, 1898.)

Contract No. 1, $6,318. (Draft dated May 18, 1898.)

Western Division.—Contract No. 5, $33,338. (Several drafts.)

None of these drafts have been honored by the Comptroller, so the amounts are not "actually paid." The amount involved on Western Division contract No. 5 is withheld by the Comptroller because of the statement made by the investigating commission that a wrong classification had been made on part of the material. This matter is now the subject of a mandamus suit on the part of the contractors to compel the Comptroller to pay it.

The amount involved on Middle Division contract No. 1 is also withheld by the Comptroller because of the investigating commission's statement that an excessive payment had been allowed. Each of the other items is withheld by the Comptroller for the reason that "the balance of the fund for the improvement of the Erie, Champlain and Oswego canals, after deducting the 10 per cent. reserved on monthly payments, and allowing for final payment on completed contracts where the final account is finished" is insufficient to allow of further payment for work.

Of the "total amount actually paid," see column F, $36,555.19 was paid by the Superintendent to put Western Division contract No. 3 in shape for navigation after the contract was cancelled. The profile submitted herewith shows the location and extent of every contract, whether completed, under contract, or yet to be awarded, to finish the entire improvement. It also shows the contractors' names and will facilitate an understanding of the foregoing.

The following statement shows briefly the total amounts expended for each of the several purposes, the present condition of the fund and the amounts required for the several purposes to complete the contracts that have been awarded:

Total amount paid on account of contracts (see column F)		$7,238,795 08
Total amount retained		694,162 58
Total paid or due on contracts		$7,932,957 66
Total paid for advertising	$92,320 70	
Total paid for inspection	180,501 36	
Total paid for disinfectants	6,482 49	
Total paid for miscellaneous items	227 44	
Total paid for engineering	820,000 00	
Total		1,099,531 99
Total of all payments made or due		$9,032,489 65
Total amount available		9,000,000 00
Deficit		$32,489 65

Add estimated amount required to finish contracts,	$4,430,007 88
Add estimated amount required to finish engineering.	236,600 00
Add estimated amount required to finish inspection	101,400 00
Total amount required to complete awarded contracts	$4,800,497 53

We desire to be distinctly understood that the foregoing figures are from the records of our departments as we find them. They were compiled by our predecessors, and have been reviewed by us in a general way only. The engineers who have been connected with the work already done feel confident that these estimates will be found reliable, as they have been revised on the basis of the work already done.

Respectfully,
JOHN N. PARTRIDGE,
Superintendent of Public Works.
E. A. BOND,
State Engineer and Surveyor.

With this data before it, the Legislature, by chapter 544, Laws of 1899, authorized the Canal Board to terminate contracts made by the State for the improvement of the Erie, Champlain and Oswego canals, and permitting the return and payment to the contractors of the moneys deposited and earned by them under such contracts, upon condition that they file a written request within sixty days after the act went into effect, asking for the termination of the contract; and also file a release from all further claims against the State by reason of such contracts. This act became a law May 25, 1899.

At a meeting of the Canal Board held on the 25th day of May, 1899, a resolution was adopted appointing a committee composed of the Attorney-General, Comptroller, Superintendent of Public Works and the State Engineer and Surveyor to investigate and report to the Board the status of the several improvement contracts for the termination of which applications were received by the Board.

The committee at once proceeded to take up the several contracts in detail scrutinizing each one carefully, item by item, and in many cases calling upon the Division and Assistant Engineers who had immediate supervision of the work during construction to appear before them to make explanation of various matters. As soon as the committee arrived at a decision in regard to an account, a statement of the amount was sent to the contractor and a report made to the Canal Board; the contractor was then notified by the Board as to the date upon which the committee's report would be considered and he was given an opportunity to appear and present his evidence, in case there were any points upon which he disagreed with the conclusions reached by the committee.

The work of the committee was laborious owing to the immense amount of detail involved, and has consumed a great amount of time; but the subject was treated in the most conscientious and thorough manner and with the earnest desire to arrive at conclusions which should be strictly just as between the State and the contractor.

Table II shows the contractors who have filed the releases and requests provided for by chapter 544, Laws of 1899; Table III the several accounts which have been finally passed by the Canal Board and paid; Table IV the final accounts not yet reached and which still wait the consideration of the Canal Board, and Table V the contracts for termination of which no requests were filed.

Table II.

The following contractors applied for the termination of contracts under chapter 544, *Laws of* 1899:

Clinton Beckwith	Contract No.	23	Eastern	Division.
Clinton Beckwith	"	27	"	"
John V. Quackenbush	"	16	"	"
John V. Quackenbush	"	24	"	"
O'Brien & Hooliban	"	19	Middle	"
Edward H. Gaynor	"	23	"	"
Willoughby B. Priddy	"	27	"	"
John Dunfee & Co.	"	4	"	"
John Dunfee & Co.	"	26	"	"
Kirk, Driscoll & Co.	"	34	"	"
John Kelly & Co.	"	7	"	"
John Kelly & Co.	"	8	"	"
John Kelly & Co.	"	9	"	"
Hughes Bros. & Bangs	"	10	"	"
Lauer & Hagaman	"	6	Eastern	"
Lauer & Hagaman	"	18	"	"
Whitmore, Ranber & Vicinus	"	14	Western	"
Whitmore, Ranber & Vicinus	"	15	"	"
Dodge & McGregor	"	6	Middle	"
Troy Public Works Co	"	19	Eastern	"
Buffalo Dredging Co.	"	2	Western	"
Baker, Banker & Hingston	"	29	Eastern	"
Baker & Banker	"	7	Western	"
Warren Scharf Asphalt Paving Co	"	20	Middle	"
Warren Scharf Asphalt Paving Co	"	21	"	"
Henry C. Allen & Co	"	13	Western	"
Walter Bradley	"	46	Middle	"
Mahan & Sundstrom	"	10	Eastern	"

The foregoing list includes all improvment contracts for the termination of which application was made under chapter 544, Laws of 1899, except contract No. 5, western division, Grannis & O'Connor, contractors, which is in litigation.

Table III.

CONTRACTS COMPLETED AND PAID.

John V. Quackenbush	No.	7	Eastern	Division.
Chambers & Casey	“	11	“	“
Shoar & Haight	“	12	“	“
John V. Quackenbush	“	13	“	“
Thomas H. Karr	“	15	“	“
Thomas H. Karr	“	17	“	“
John Twomey	“	52	“	“
T. J. Dwyer & Co	“	12	Middle	“
Hughes Bros. & Bangs	“	13	“	“
John Kelly & Co	“	14	“	“
Owego Bridge Co	“	17	“	“
Rochester Bridge and Iron Works	“	47	“	“
Donnelly Contracting Co	“	1	Western	“
Whitmore, Ranber & Vicinus	“	4	“	“
Randerson & Seward	“	11	Middle	“
Walter Bradley	“	15	“	“
Edwin Lodder	“	36	“	“
Edwin Lodder	“	16	“	“
Willard Johnson	“	37	“	“
Whalen & Higgins	“	8	Eastern	“
John W. Whalen	“	9	“	“
John W. Flynn	“	30	“	“
C. J. Reardon & Co	“	31	“	“
Monty & Higley	“	53	“	“
Lauer & Hagaman	“	8	“	“

The last of the above was finally settled December 5, 1899.

Table IV.

COMPLETED CONTRACTS—UNPAID.

John W. Whalen	No.	2	Eastern	Division
Gallo & McNiece	“	4	“	“
Brummelkamp, Lane & Co	“	5	“	“
T. J. Dwyer & Co	“	1	Middle	“
McDonald & Sayre	“	2	“	“
John Dunfee & Co	“	3	“	“
John Dunfee & Co	“	5	“	“
O'Brien & Hoolihan	“	18	“	“

CANCELLED CONTRACT FINISHED BY DEPARTMENT OF PUBLIC WORKS.

Chas. F. Parker & Co	No.	3	Western	Division

Table V.

UNFINISHED CONTRACTS..

No application under Chapter 544, Laws of 1899.

National Contracting Co	No.	22	Middle	Division.
National Contracting Co	“	24	“	“
National Contracting Co	“	25	“	“
Andrew Underdonk	“	28	“	“
Furnaceville Iron Company	“	6	Western	“
Williams, McNaughton & Bapst	“	8	“	“
Furnaceville Iron Company	“	9	“	“
Furnaceville Iron Company	“	10	“	“
Furnaceville Iron Company	“	11	“	“
Furnaceville Iron Company	“	12	“	“
Pulford & Compton	“	28	Eastern	Division (C).

The above contracts under Table 5 cannot be finally adjusted and disposed of until the Legislature has passed a bill which gives authority to some State official or State board to act in the matter.

It would appear that a decision as to the future disposition to be made of the canals in this State must soon be made and definite action taken. As has been pointed out in the previous reports the best results from previous expenditures have not been obtained owing to the fact that the full scope of the improvement contemplated has not been carried out, and consequently the work already completed, while excellent so far as it goes, does not bring the entire canal to a uniform measure of capacity or efficiency.

With a view of obtaining the best and fullest information possible on this subject, Governor Roosevelt appointed the Committee on Canals of New York State early in 1899, with instructions to make the most careful and thorough investigation within its power, and report to him before the meeting of the Legislature of 1900.

This committee has devoted a great amount of time and labor to the matter, and has endeavored to make an exhaustive study which shall cover every feature of canal investigation both in this country and abroad.

For the purpose of obtaining an idea of the general feeling throughout the State, a communication was sent to a large number of business and professional men and others who are interested in the subject of canals, in different sections of the State, asking for a full expression of opinion as to the best disposition to be made of the matter.

A large number of replies were received varying in opinion as to the solution of the problem; but very few, if any, even from the sections of the State where most opposition has developed to the expenditure of money for improvement of canals, advocated the abandonment of the canals, and nearly all agreed in the opinion that the State could not afford to fall behind the times in the matter of the maintenance and development of its waterways.

In addition to the numerous meetings which the Committee has held, it has visited and carefully inspected the canals of this State and Canada; it has held public meetings in various cities of the State; it has caused to be made, by engineers especially employed for the purpose, a careful and thorough estimate of the cost of different plans above mentioned, and has in every possible way endeavored to secure the necessary data and knowledge to enable every member of the Legislature and the people of the State to form a clear idea as to the present requirements to the end that they might act intelligently and judiciously.

The Committee's report will be in the hands of the Legislature, doubtless, when it convenes, and knowing as I do how full and complete the report will be I have decided not to attempt, in this annual report, to take up the subject of suggestions as to the future course to be pursued in connection with the enlargement of our canals.

PNEUMATIC OR MECHANICAL LIFT LOCKS.

Any project now considered for canal enlargement or construction will differ radically from former plans in that recent inventions now make possible high lifts which were impracticable with the old style of locks in which the hydraulic pressure increased with the increase in lift, making 20 feet lift about as high as was thought practicable, and 30 feet an extreme limit.

The State officials in 1897 adopted plans for pneumatic locks to be built at Cohoes and Lockport and the last legislature in chapter 519 of the Laws of 1899 passed a bill authorizing the construction of such locks by private capital at Cohoes and their lease or purchase by the State after successful operation.

The construction of pneumatic or mechanical high lift locks at these points if successful will simplify operations, will relieve navigation at points where boats have been most delayed and will greatly expedite their passage through the canals.

ENGINEERING EXPENSES FOR THE FISCAL YEAR.

EASTERN DIVISION.

ORDINARY REPAIRS.

Erie canal, chapter 550, Laws of 1898 and chapter 569, Laws of 1899	$10,804 06
Champlain canal, chapter 550, Laws of 1898 and chapter 569, Laws of 1899	5,372 59

EXTRAORDINARY REPAIRS.

Erie canal, chapter 506, Laws of 1898 and chapter 208 Laws of 1899	2,931 66
Champlain canal, chapter 506, Laws of 1898 and chapter 208, Laws of 1899	967 69
Erie canal, chapters 79, Laws of 1895; 294, Laws of 1896; 43, Laws of 1897; 569, Laws of 1897	400 72
Champlain canal, chapters 79, Laws of 1895; 794, Laws of 1896; 43, Laws of 1897; 569, Laws of 1897	541 55
Erie canal, building stone arch culvert at Little Falls, chapter 91, Laws of 1899	401 58

Erie canal, Rexford Flats dam, chapter 560, Laws of 1895; chapter 947, Laws of 1896; chapter 566, Laws of 1897	$256 87
Erie canal, Fort Plain lift-bridge, chapter 576, Laws of 1897	777 92
Erie canal, repairs to Moyer creek, chapter 128, Laws of 1898	258 00
Erie canal, bridge at German street, Little Falls, N. Y., chapter 680, Laws of 1895	245 00
Erie canal, bridge in town of Minden, chapter 596, Laws of 1899	93 39
Erie canal, lift-bridge at Cananjoharie, N. Y., chapter 477, Laws of 1899	40 61
Champlain canal, bridge at Ontario street, Cohoes chapter 613, Laws of 1899	85 65
Glens Falls Feeder, bridge Main street, Sandy Hill, chapter 623, Laws of 1898	126 94
Blue line maps of Erie, Oswego and Champlain canals, chapter 569, Laws of 1899	184 50

SPECIAL WORK.

Dike on Neversink river, chapter 291, Laws of 1897	72 00
Removing obstructions and erecting a dam on Racquette river, chapter 569, Laws of 1899	172 00
Building a wall at Washington headquarters at Newburgh, chapter 606, Laws of 1898	177 79
Changing channel at Bashas Kill stream at junction with Pine Kill, chapter 621, Laws of 1898	351 40
Building dam across Saranac river at Saranac lake, chapter 627, Laws of 1898	568 90

Repairs to draw bridge Minnisceongo creek, chapter 631, Laws of 1898	$369 71
Deepening and widening canal between Shinnecock and Great South Bay, chapter 207, Laws of 1898	813 03

SPECIAL SURVEYS.

Survey for State Board of Claims, chapter 606, Laws of 1898 and chapter 569, Laws of 1899	6,708 84
Keeping and preserving old maps, survey notes, etc., chapter 569, Laws of 1899	574 50
Old records, maps and surveys, chapter 790, Laws of 1897	879 70
Maps, shore lines of Westchester county, chapter 950, Laws of 1896, and chapter 569, Laws of 1899	1,415 66
Examination maps, monuments, etc., chapter 606, Laws of 1898, and chapter 569, Laws of 1899	3,188 59
Boundary line survey between Lewis and Herkimer counties, chapter 569, Laws of 1899	5,244 45
Topographic survey, chapter 219, Laws of 1898, and chapter 96, Laws of 1899	20,297 84
Improvement of public highways, chapter 115, Laws of 1898, and chapter 569, Laws of 1899	9,226 23

MIDDLE DIVISION.

ORDINARY REPAIRS.

Erie canal, chapter 435, Laws of 1897; chapter 550, Laws of 1898; chapter 569, Laws of 1899; chapter 571, Laws of 1899	$18,266 68
Oswego canal, chapter 550, Laws of 1898	726 75
Black River canal, chapter 505, Laws of 1898	825 65
Cayuga and Seneca canal, chapter 569, Laws of 1899	50 84

EXTRAORDINARY REPAIRS.

Erie canal, chapter 208, Laws of 1899	$165 54
Oswego canal, chapter 208, Laws of 1899	102 50
Black River canal, chapter 208, Laws of 1899	235 22

SPECIAL APPROPRIATIONS — ERIE CANAL.

Lift-bridge at Whitesboro street, Utica, chapter 563, Laws of 1897	671 60
Lift-bridge at Broad street, Utica, chapter 565, Laws of 1897	818 17
Lift-bridge at Salina street, Syracuse, chapter 571, Laws of 1897	1,070 63
Completing approaches to bridge, Otisco lake, chapter 615, Laws of 1898	220 74
Repairing and protecting bank, Oriskany creek feeder, chapter 620, Laws of 1898	30 00
Vertical wall, Oneida feeder, chapter 633, Laws of 1898	410 71
Peterboro street bridge, Canastota, chapter 626, Laws of 1898	493 26
Catherine street bridge, Syracuse, chapter 424, Laws of 1898	481 84
Schuyler street bridge, Utica, chapter 427, Laws of 1898	117 98
Washington street bridge at Utica, chapter 377, Laws of 1898	269 13
Cayuga and Seneca. Removal of bars of Cayuga, chapter 606, Laws of 1898	284 71
Ditch between Seneca Falls and Waterloo, chapter 686, Laws of 1897	170 37

Light house at Cayuga, chapter 425, Laws of 1898....	$25 00
Repairing Liberty street bridge at Pen Yan, chapter 190, Laws of 1898	41 66

SPECIAL SURVEYS.

Surveys and maps for State Board of Claims, chapter 569, Laws of 1899	1,974 22
Seneca lake survey, chapter 501, Laws of 1899.......	1,817 62
Cornell land survey, chapter 122, Laws of 1898.......	2,052 48
Improvement of public highways, chapter 115, Laws of 1898	3,585 95

WESTERN DIVISION.

ORDINARY REPAIRS.

Erie canal, chapter 435, Laws of 1897, chapter 550, Laws of 1898, chapter 569, Laws of 1898..........	$12,544 12

EXTRAORDINARY REPAIRS.

Monroe avenue bridge, Rochester, chapter 207, Laws 1897, chapter 607, Laws of 1898, chapter 477, Laws 1899	591 37
South Clinton street bridge, Rochester, chapter 339, Laws of 1897, chapter 477, Laws of 1899	916 38
South Fitzhugh street bridge, Rochester, chapter 32, Laws of 1897, chapter 606, Laws of 1898, chapter 477 of the Laws of 1899	1,287 50
South avenue bridge, Brighton, chapter 618, Laws of 1898...	125 07
" New Home bridge," chapter 630, Laws of 1898.....	192 14

Erie street bridge, Buffalo, chapter 611, Laws of 1898.	$1,308 44
Hamilton street bridge, Buffalo, chapter 568, Laws of 1897.	297 15
Exchange street bridge, Rochester, chapter 514, Laws of 1895, chapter 572, Laws of 1895, chapter 791, Laws of 1897	606 08
Main street bridge, Pittsford, chapter 504, Laws of 1898.	330 28
Ferry street bridge, Buffalo, chapter 618, Laws of 1899.	2 30
Chapel street bridge, Lockport, chapter 573, Laws of 1899.	70 24
Protecting unfinished work under general improvement, chapter 506, Laws 1898	1,192 17
Erie canal enlargement, chapter 79, Laws of 1895, chapter 594, Laws of 1896, chapter 43, Laws of 1897, chapter 569, Laws of 1897	1,230 22
Enlarging Spillway Cuba Reservoir, chapter 607, Laws of 1898	127 26
Glens Falls Improvement Watkins, chapter 624, Laws of 1898	147 41
Montour Falls, drainage of Chemung canal, chapter 569, Laws of 1899	149 62
Drainage levels at Brighton, chapter 208, Laws of 1899	91 11
Culvert No. 31, east of Pittsford, chapter 208, Laws of 1899	98 94
Brockport culvert, No. 59, chapter 208, Laws of 1899	65 35
Brockville waste wier, chapter 208, Laws of 1899	44 33

South St. Paul street wall, Rochester, chapter 208, Laws of 1899	$79 06
Jackson bridge No. 141, chapter 208, Laws of 1899	10 00
Beals bridge No. 136, chapter 208, Laws of 1899	49 00
Elk street bridge wall, Buffalo, chapter 208, Laws of 1899	15 75
Delaware street culvert, Tonawanda, chapter 632, Laws of 1898	254 87
Eighteen Mile creek improvement, chapter 609, Laws of 1898	29 95
Improvement Bull creek, east bank, chapter 569, Laws of 1899	1 92
Bridge at Medina over canal feeder, chapter 606, Laws of 1898, chapter 569, Laws of 1899	18 39
Mud creek improvement, chapter 572, Laws of 1899	739 58
Improving and deepening Erie basin, chapter 635, Laws of 1898	1,309 20
Culverts Nos. 42, 43, 45 and 56, chapter 566, Laws of 1897	741 48
Survey for Court of Claims, chapter 569, Laws of 1899	2,076 38

GENERAL FUND.

Allegany Indian reservation, highways, chapter 790, Laws of 1897, chapter 569, Laws of 1899	420 45
Cattaragus Indian reservation, highways, chapter 790, Laws of 1897, chapter 569, Laws of 1899	52 34
Tonawanda Indian reservation, highways, chapter 790, Laws of 1897, chapter 606, Laws of 1898, chapter 210, Laws of 1899	229 85

Cattaraugus Indian reservation, repairing road and bridge at Brant, chapter 606, Laws of 1898	$60 00
Cattaraugus Indian reservation, Clear creek bridge, chapter 569, Laws of 1899	4 37
Newtown creek improvement, chapter 949, Laws of 1896, chapter 791, Laws of 1897, chapter 607, Laws of 1898	509 52
Watkins harbor improvement, chapter 697, Laws of 1899	369 51
Improvement of public highways, chapter 115, Laws of 1898	6,945 93

SPECIAL WORK.

Oyster bed surveys, chapter 606, Laws of 1898, and chapter 569, Laws of 1899	1,715 23

Bridge Designer and Inspector.

Chap. 476, Laws 1899.
Chap. 569, Laws 1899.

NAME.	Rank.	Rate of Compensation.	Salary.	Travel.	Total.
W. R. Davis	Chief Designer	$2,400 per year	$461.52	$63.00	$524.52
G. A. Fairbanks	Mech'l Draft'n	$5.00 per day	300.00		300.00
C. T. Middlebrook	Asst Engineer	5 00 per day	130.00		137.73
L. B. Jones	Leveller	4 50 per day	67.50		67.50
G. L. Schillner	Draftsman	4.50 per day	36.00		36.00
C. D. Burrns	Draftsman	4 50 per day	63 00		63.00
					$1,128.75
Incidental Expenses, Miscellaneous, Desks, Drafting Material, etc					86.48
Total					$1,215.23

Table of Contracts Pending on September 30, 1899.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	LEGISLATIVE ACT.		Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payments to date.
				Chapter.	Year.			
E. W. Wicks	June 14, 1898	Dredging channel betwen Shinnecock and Great So. Bay	$10,000 00	207	1898	$8,500 00	$5,440 00	$5,474 00
Gillette, Hay & Gillette	May 16, 1899	Draw Bridge, Minisceongo Creek	6,000 00	631	1898	5,045 00	4,260 00	3,298 00
Gillette, Hay & Gillette	May 1, 1899	Dam, Saranac River	10,000 00	627	1898	9,330 00	7,693 00	2,516 00
Geo. A. Rogers	July 21, 1899	Troy & Brunswick road improvement	50,000 00	115	1898	8,173 00	5,675 00	2.468 63
John Twoomey	July 5, 1899	Wall, Washington's Headquarters	5,000 00	606	1898	4,195 00	3,987 00	2,550 00
Hallinan Bros	Aug. 8, 1899	Arch culvert, Little Falls, N. Y	6,000 00	91	1899	5,032 00	4,490 00	1,394 00
Geo. A. Rogers	July 21, 1899	Troy & Greenbush road improvement	50,000 00	115	1898	9,686 00	7,907 50	830 29
Monty, Highley & Barber	Apr. 21, 1899	Bridge, Main st., Sandy Hill	6,000 00	623	1898	5,394 00	5,443 20	....
G. D. Grannis	Aug. 2, 1899	Dredging Cayuga & Seneca Canal	10,000 00	606	1898	8,800 00	7,025 00	892 50
Walter Bradley & Co	July 18, 1899	Vertical Walls, etc., Fulton, N. Y	2,766 14	113-477	1897-99	2,486 75	2,179 00	....
Walter Bradley & Co	Sept. 18, 1899	Bulkhead and gates at Fulton, N. Y	Extraordinary repair fund.	208	1899	2,645 00	2,611 00	....
Walter Bradley & Co	Sept. 11, 1899	Rebuilding lock 47, Black River Canal		208	1899	19,945 00	15,776 30	....
Walter Bradley & Co	Sept. 11, 1899	Rebuilding lock 64, Black River Canal		208	1899	19,945 00	15,776 30	....
Gillette, Hay & Gillette	May 29, 1899	Approaches to bridge, Otisco lake inlet	$10,000 00	615	1898	8,847 50	6,943 00	1,666 00
W. J. Marson	May 29, 1899	Repair bridge, Liberty st., Pen Yan	1,500 00	190	1898	1,308 50	1,182 00	....
Havana Bridge Works	May 31, 1899	Bridge, Peterboro st, Canastota	18,000 00	626	1898	15,318 75	15,639 10	....
Havana Bridge Works	April 21, 1899	Bridge, Schuyler st, Utica	18,000 00	427	1898	10,000 00	10,480 00	....
T. J. Dwyer & Co	Oct 4, 1898	Improvement Deerfield road	50,000 00	115	1898	15,968 00	13,806 35	10,251 22
Clark & Hibbard	July 6, 1899	Improvement Cortland st. road	50,000 00	115	1898	4,831 34	4,375 00	1,640 63
Clark & Hibbard	Sept. 21, 1899	Supplemental contract Cortland st road	50,000 00	115	1898	7,525 00	6.828 00	....
F. O. Sterling	July 1, 1899	Improvement James st. road	50,000 00	115	1898	3,463 80	3,450 00	2,870 25
F. O. Sterling	Sept. 21, 1899	Supplemental contract James st. road	50,000 00	115	1898	3,625 00	3,265 00	....
Gillette, Hay & Gillette	Aug. 3, 1899	Improvement Newtown Creek	5,000 00	949-791-607	1896 1897 and 1898	4,330 00	3,945 00	....
Havana Bridge Works	May 16, 1899	S. ave. bridge Brighton	25,000 00	618	1898	24,059 50	22,498 00	....
Hilton Bridge Co	May 29, 1899	New home bridge	15,000 00	630	1898	11,610 00	10,641 50	....
B. P. Smith	Apr. 21, 1899	Main st. bridge, Pittsford	19,000 00	504	1898	17,042 50	16,541 00	....
Buffalo Bridge & Iron Works	Mch. 23, 1899	Erie st. bridge, Buffalo	27,000 00	611	1898	22,893 50	18.723 00	....
Gillette, Hay & Gillette	Apr. 21, 1899	Delaware st. culvert, Tonawanda	6,000 00	632	1898	5,267 00	4,708 75	....
Jas. B. Donnelly	Nov. 10, 1899	Dredging Erie basin	30,000 00	635	1898	25,520 00	23,988 00	....
Henry P. Burgard	Oct. 4, 1898	WhiteCorners plank road improvement	50,000 00	115	1898	35,011 25	24,750 00	15,285 00
Gillette & Gillette	Mch. 6, 1899	East ave. road improvement	50,000 00	115	1898	10,993 00	10,500 00	3,307 50
Chambers & Casey	Aug. 16, 1899	Ridge road improvement	50,000 00	115	1898	36,000 00	36,000 00	3,240 00

Table of Contracts Completed During the Year Ending September 30, 1899.

NAME OF CONTRACTOR.	Date of Contract.	Character of Work	Appropriation.	LEGISLATIVE ACT.		Engineer's Estimate.	Final Estimate.
				Chapter.	Year.		
Rochester Bridge and Iron Works	Nov. 16, 1895	Bridge, German St., Little Falls	$8,000 00 4.946 50	680 572	1895 1897	$7,445 40	8,075 68
Whalen & Higgins	Sept. 14, 1897	Repair Dam at Rexford Flats	20,000 00 9,424 00 7,444 00 8,234 00	560 947 566 550	1895 1896 1897 1898	25,981 50	34,283 90
P. J. Brumelkamp	Aug. 28, 1897	Repairs, Shinnecock & Peconic Canal	(Agreement)	791	1897	....	4,499 06
Hilton Bridge Co	July 27, 1897	Bridge, Railroad St., Ilion	18,000 00	105	1897	13,678 20	16,402 69
Lauer & Hagaman	Nov. 17, 1896	Improvement Erie Canal, Lock 27 to Lock 28	9,000,000 00	79 794 43 and 569	1895 1896 1897	74,159 35	127,946 10
Brumelkamp, Lane & Co	Nov. 16, 1896	Improvement Erie Canal, Lock 32 to Lock 33	9,000,000 00	79 794 43 and 569	1895 1896 1897	88,434 85	130,025 42
J. W. Whalen	Nov 10, 8196	Improvement Erie Canal, Lock 20 to Lock 21	9,000,000 00	79 794 43 and 569	1895 1896 1897	52,910 50	80,845 20
Joseph H. Conners	Feb. 21, 1899	Rebuilding Culvert No.31, Erie Canal	350,000 00	506	1998	3,990 40	4,277 00
The Callanan Road Improvement Co	Sept. 7, 1898	Improvement Troy and Schenectady Road	50,000 00	115	1898	14,590 00	14,590 00
Edward A. Matthews	Oct. 25, 1898	Improvement Lebanon and Pittsfield Road	50,000 90	115	1898	7,200 00	7,200 00
Lauer & Hagaman	Nov. 17, 1896	Improvement Erie Canal, Lock 33 to Lock 34	9,000,000 00	79 794 43 and 569	1895 1896 1897	43,831 25	66,396 99
John V. Quackenbush	Sept. 21, 1897	Improvement Erie Canal, Lock 45 to Oneida County E. Line	9,000,000 00	79 794 43 and 569	1895 1896 1897	181,988 00	82,146 06
Clinton Beckwith	Sept. 21, 1897	Improvement Erie Canal, Lock 40 to Lock 41	9.000,000 00	79 794 43 and 569	1895 1896 1897	53,000 00	14,827 25
Clinton Beckwith	Sept. 21, 1897	Improvement Erie Canal, Lock 39 to Lock 40	9.000,000 00	79 794 43 and 569	1895 1896 1897	69,829 00	59,913 02
Brumelkamp, Lane & Co	May 26, 1899	Changing Channel of Basha Kill	5,000 00	621	1898	3,780 00	2,953 98
William Coats	Aug. 7, 1899	Dam at Racquette River	2,500 00	569	1899	2,268 00	2,268 00

Table of Contracts Completed During the Year Ending September 30, 1899—(Concluded).

NAME OF CONTRACTOR.	Date of Coutrabt.	Character of Work.	Appropriations	LEGISLATIVE ACT.		Engineer's Estimate.	Final Estimate.
				Chapter.	Year.		
John Kelley	Mch. 23, 1899	Vertical Retaining Walls, Oneida Feeder	8,000 00	633	1898	7,000 00	4,641 96
Groton Bridge & Mfg. Co	Feb. 24, 1898	Bridge, Salina St, Syracuse, N. Y.	36,000 00	571	1897	35,425 00	30,694 65
Groton Bridge & Mfg. Co	Feb. 24, 1898	Bridge, Whitesboro St., Utica, N. Y.	20,000 00	563	1897	25,567 00	20,676 67
Havana Bridge Works	Feb. 28, 1897	Bridge, Broad St, Utica, N. Y.	25,000 00	565	1897	22,816 50	17,022 28
John R. Briggs	May 25, 1899	Repair Banks, Oriskany Creek Feeder	1,500 00	630	1898	1,200 00	879 56
Havana Bridge Works	Nov. 5, 1898	Lighthouse at Cayuga N. Y	400 00	425	1898	375 00	346 00
John Dunfee & Co	Nov. 14, 1896	Improvement of Erie Canal	9,000,000 00	79 794 43 and 569	1895 1896 1897	142,798 00	234,339 27
John Dunfee & Co	Nov. 14, 1896	Improvement of Erie Canal	9,000,000 00	79 794 43 and 569	1895 1896 1897	150,614 50	242,403 76
O'Brien & Hoolihan	Mch. 19, 1897	Improvement of Erie Canal	9,000,000 00	79 794 43 and 569	1895 1896 1897	96,373 00	208,336 76
Rochester Bridge and Iron Works	Nov. 13, 1897	Improvement of Erie Canal	9,000,000 00	79 794 43 and 569	1895 1896 1897	12,425 00	15,735 28
Willard Johnson	Aug. 30, 1897	Improvement of Oswego Canal	9,000,000 00	79 794 43 and 569	1895 1891 1897	13,836 00	12,053 16
W. A. Gillette	Oct. 9, 1897	Improving Cayuga Creek	5,000 00	559	1897	4,380 00	3,796 76
Rochester Bridge and Iron Works	Sept. 9, 1899	Bridge, Fitzhugh St, Rochester	27,000 00	32 606 477	1897 1898 1899	25,969 75	24,475 73
Rochester Bridge and Iron Works	Aug. 18, 1899	Bridge, S. Clinton St., Rochester	20,000 00	339 477	1897 1899	15,862 00	16,850 22
B. P. Smith	Aug. 3, 1899	Bridge, Monroe Ave, Rochester	36,000 00	207 607 477	1897 1898 1899	29,701 65	33,303 20
John Calnan	June 27, 1899	Repair Culverts 40, 42, 45 and 56		566	1897	9,127 00	10,669 18
Buffalo Dredging Co	Mch. 21, 1899	Bridge, Hamilton St., Buffalo	10,000 00	568	1897	8,055 00	9,285 17
Chambers & Casey	Apr. 14, 1899	Bridge, Exchange St., Rochester	25,000 00 15,000 00 6,645 74	514 572 791 506	1895 1897 1897 1898	41,337 00	46,544 99

HIGHWAY IMPROVEMENT.

It is generally conceded that no duty of the Government is more urgent than to see that commerce has efficient and cheap means of transportation. This State won its supremacy by an early recognition of this demand and by the provision of a great line for traffic by way of its canal system. But it is only now coming to be recognized that it is as important to lasting prosperity that good highways shall be provided and maintained for the daily use of the people as it is to have main traffic lines for general commerce.

In other words, it is as desirable to enable the farmer of New York State to save a dollar on the hauling of a ton of apples five miles to his nearest market as it is to enable the grain dealer to save a dollar in transporting a ton of grain 500 miles from the Lakes to tide water.

Each is good in its way and one is as needful as the other for the public profit.

Recognizing this fact, much attention has been given to the subject of highway improvement under the provisions of the Higbie-Armstrong act.

The comparatively small appropriations of $50,000 made in each of the past two years since the passage of this law are considered as no indications of the importance in which the subject is held by the Legislature and the people of the State; every effort has therefore been made that the short pieces of road which have been built and which vary in length from one-half mile to six miles each, should be located and constructed as carefully as possible to secure the best results.

In doing this, full use has been made of the experience acquired in road construction by other States and by the General

Government supplemented by investigations and experience by this Department. The results obtained in the roads built have fully justified the choice of men and methods, and the roads built have received most cordial approval of all concerned.

"Improvement of Public Highways" Bulletin No. 1 (see appendix "A") was issued in April 1899, and the requests for copies of it have evidenced a widespread interest, the first issue of fifteen thousand not being sufficient to supply the calls which have been made.

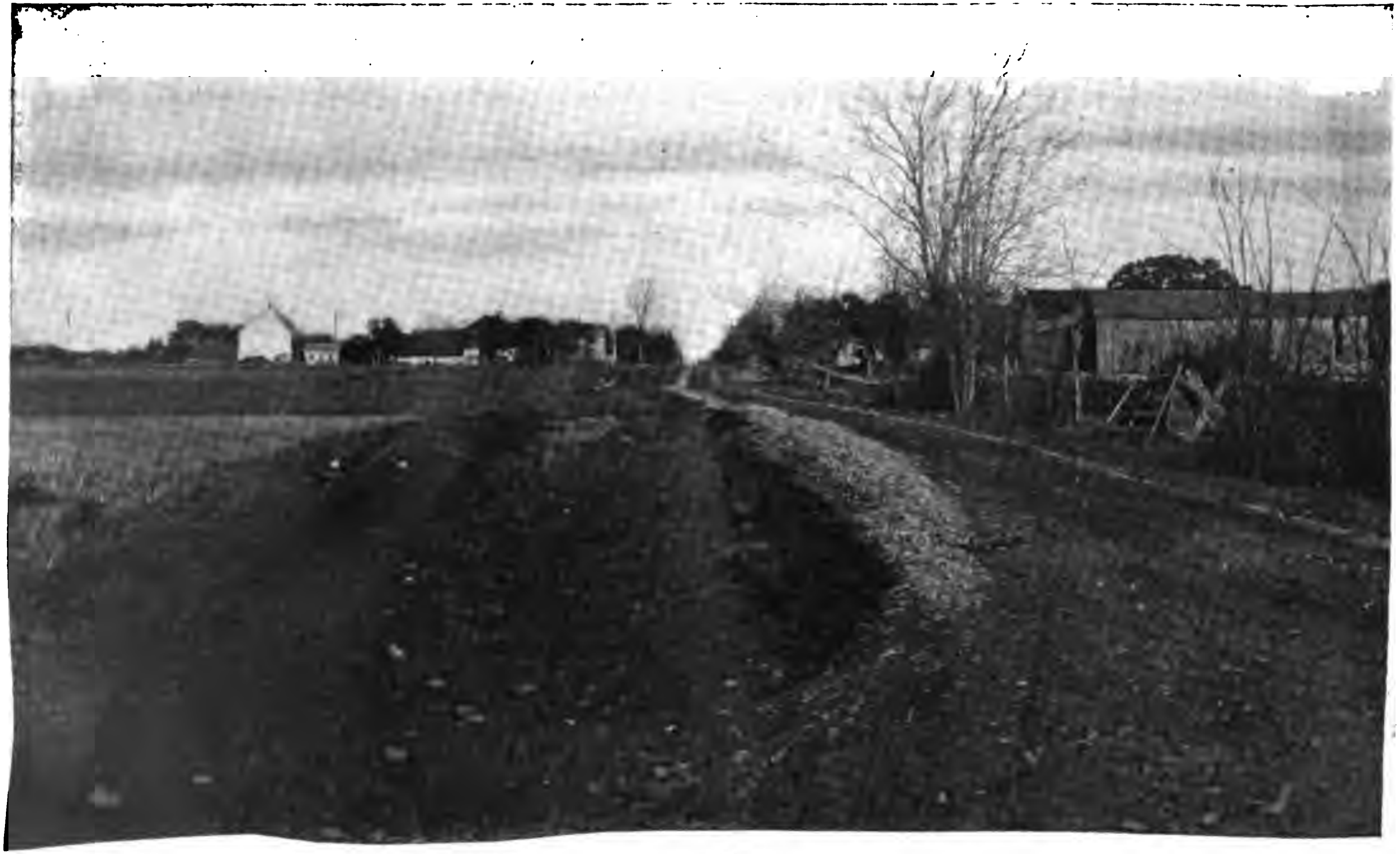
The specifications of more recent date embody various features which are based upon later experience, and are in each case adapted to local conditions and materials, with such improvements in methods and requirements as are suggested during actual construction here and elsewhere

Bulletin No. 2, dated October 1899 (see appendix "B") deals more especially with the subject of the maintenance of the roads.

The attention of the Legislature is respectfully called to the need for some further provision to secure such maintenance and to define the powers and duties of the county officials.

There seems to be little need to stimulate public interest in the subject of good roads. The change of public opinion regarding the improvement of highways by State aid has been most marked in this State as well as in the States of New Jersey and Massachusetts which took the lead in State road building. In the latest annual report for New Jersey a statement is made which is equally true regarding this State and which is as follows:—

"The wheelmen came in force before the Legislature and succeeded in persuading them that it was necessary for the development of the State to enact a State aid law. The farmers were there in numbers equally strong to oppose it. Now the wheel-



Unskilled Road-Improvement. Showing efforts of Traffic to get away from it.

men are comparatively quiet, while the farmers are now the pleaders and the workers; they having filed many petitions and are daily filing more."

Some of the counties near New York city are going on to improve their highways at their own cost rather than await State aid, one county proposing to expend a large sum in this way, only asking that the State Engineer make the surveys and prepare the plans and specifications. Surveys have been made covering 45 miles in that county.

The crude efforts to improve highways by working out the road tax under the unskilled direction of pathmasters and highway overseers are estimated to annualy cost the 61 counties of the State an average of $54,000 each, or $3,250,000 per year, which large sum is expended with no permanent results, and often with actual damage to the roads thus worked.

In some cases this costly and ineffective system is giving way to the adoption by towns of the money system of road tax, and to the use of modern road machinery in place of the old-time plows and scrapers. (See chap. 351, Laws 1898.) Seventy-five towns in 15 counties have availed themselves of the provisions of this law and have received a rebate of 25 per cent. of the amount of their highway taxes.

WIDE TIRES.

In a few cases, towns have also required the use of wide tires upon their roads, and in future contracts for highway improvement it may be specified that all wagons employed upon the work shall be thus equipped. The advantages of using wide tires, which certainly improve the roads, as compared with narrow tires which certainly destroy them are so evident that the introduction of a few examples will soon lead to their general use.

HIGHWAYS WHICH HAVE BEEN IMPROVED.

The Higbie-Armstrong act became a law March 24, 1898, and under its provisions there have been made two appropriations of $50,000 each, or $100,000 in all, which sum has been apportioned to paying one-half of the cost of about 25 miles of roads completed and in progress whose location, description and cost are shown in the following table:

Troy and Schenectady Turnpike Showing Culvert at Road Junction.

Roads completed in 1899 *under* 1898 *contracts.*

No.	NAME OF ROAD.	County.	Length, miles.	WIDTH.		Maximum grade in feet per 100.	Cost per mile, including survey's and supervision.	Inches.	Material.
				Between Ditches, feet.	Macadam Roadway, feet.				
1	Troy and Schenectady (from Schenectady east)..	Schenectady.	2.	22	16	5	$8,259—	2 4	Trap surface. Limestone base.
2	Buffalo and Hamburg Road (from Buffalo south).	Erie	6.54	22	12	3½	4,553	2 4	Local limestone surface. Local limestone base.
3	Deerfield, or River Road (from Utica east).......	Oneida.......	2.25	22	12	3½	7,360	2 4	Trap surface. Limestone base.
4	Lebanon and Pittsfield Road (from Lebanon to State line)......................................	Columbia.....	1.23	21	16	5	8,124	6	Local gravel.
			12.02	Average per mile..			*$7,074		

Roads in progress under 1899 *contracts.*

No.	NAME OF ROAD.	County.	Length, miles.	Between Ditches, feet.	Macadam Roadway, feet.	Maximum grade in feet per 100.	Cost per mile, including survey's and supervision.	Inches.	Material.
5	East Avenue Road (from Rochester east)..........	Monroe.......	2.45	22	12	$3\frac{8}{10}$	$5,850*	2 4	Trap surface. Local limestone base.
6	Little Ridge Road (from Rochester west)..........	Monroe......	6.53	26	16	3	5,962*	2 4	Trap surface. Local sandstone base.
10	Troy and Brunswick Road (from Troy northeast.)	Rensselaer...	1.	22 to 25	15	....	7,254*	2 4	Trap surface. Local limestone base.
11	Troy and Greenbush Road (from Troy south.)	Rensselaer...	1.03	22	15	....	9,546*	2 4	Local limestone base. Trap surface.
			11.61	Average per mile..			$7,028		

Roads of extra thickness.

No.	NAME OF ROAD.	County.	Length, miles.	Between Ditches, feet.	Macadam Roadway, feet.	Maximum grade in feet per 100.	Cost per mile, including survey's and supervision.	Inches.	Material.
8	Cortland Street Road (from Syracuse south).......	Onondaga....	1.20	18	15	$2\frac{7}{10}$	10,457*	3 6	Trap surface. Local limestone base.
9	James Street Road (from Syracuse east)...........	Onondaga....	.58	18	15	$6\frac{7}{10}$	12,824*	3 6	Trap surface 15 feet. Local limestone base 12 feet.

* Approximate.

The first roads to be improved under this law were contracted for during 1898 and were completed during 1899 and consisted of four highways located in four counties and aggregating 12 and 2-100 miles in length.

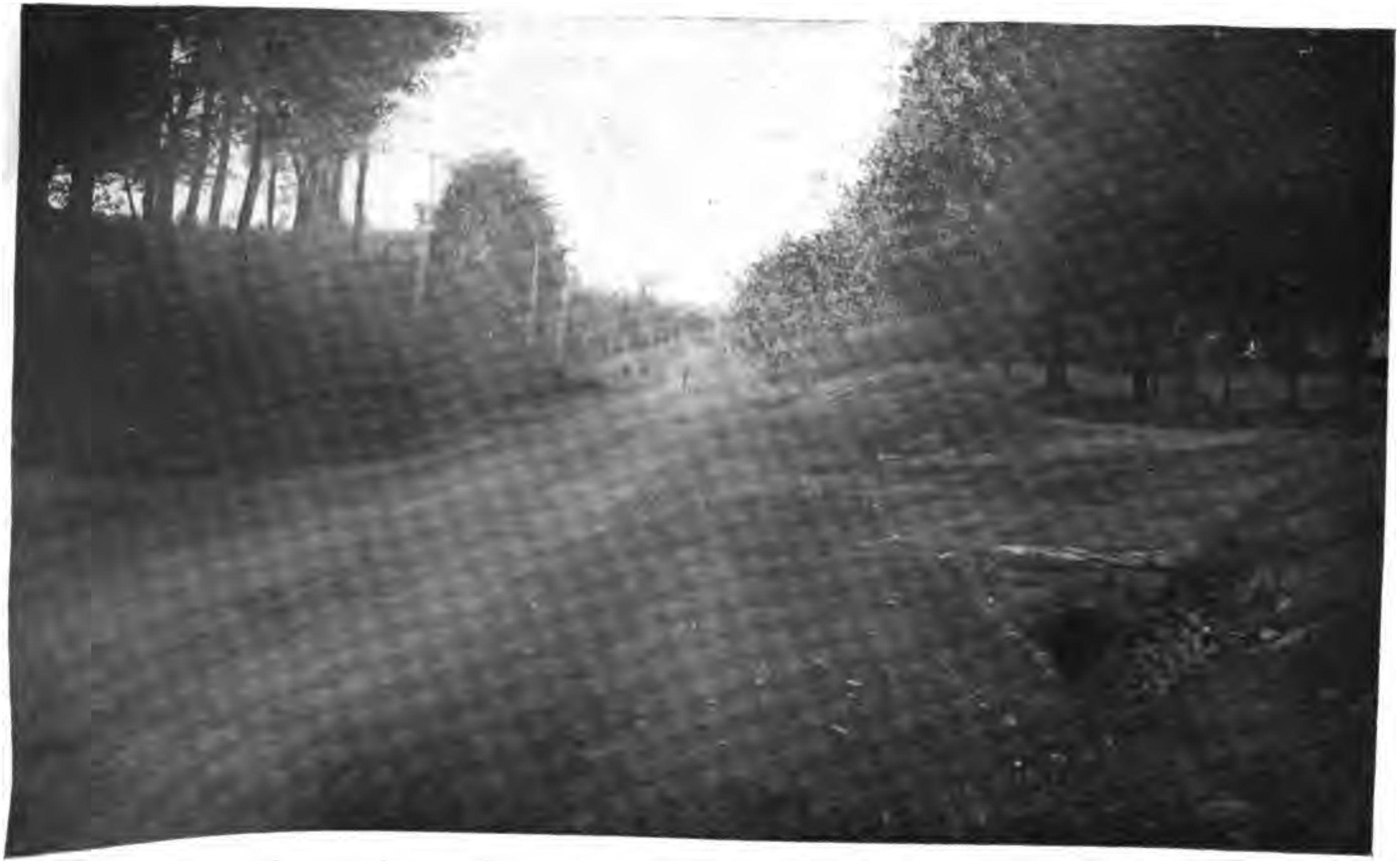
A history of the work is as follows:

Road No. 1, known as the "Troy and Schenectady Road" located in Schenectady county, leading east from Schenectady towards Troy; length of road 2 miles; width of macadam surface 16 feet, formed of four inches of limestone base covered with two inches of trap rock surface. Total cost of completed road $16,517 or $8,259 per mile.

Road No. 2, known as the "White Corners or Hamburg Road," located in Erie county, leading south from Buffalo to Hamburg; length of road 6.54 miles; width of macadam surface 12 feet, formed of four inches of limestone base covered with two inches of limestone surface. Total cost of road about $29,775 or $4,553 per mile. This road is nearly finished but has not yet been accepted by the State.

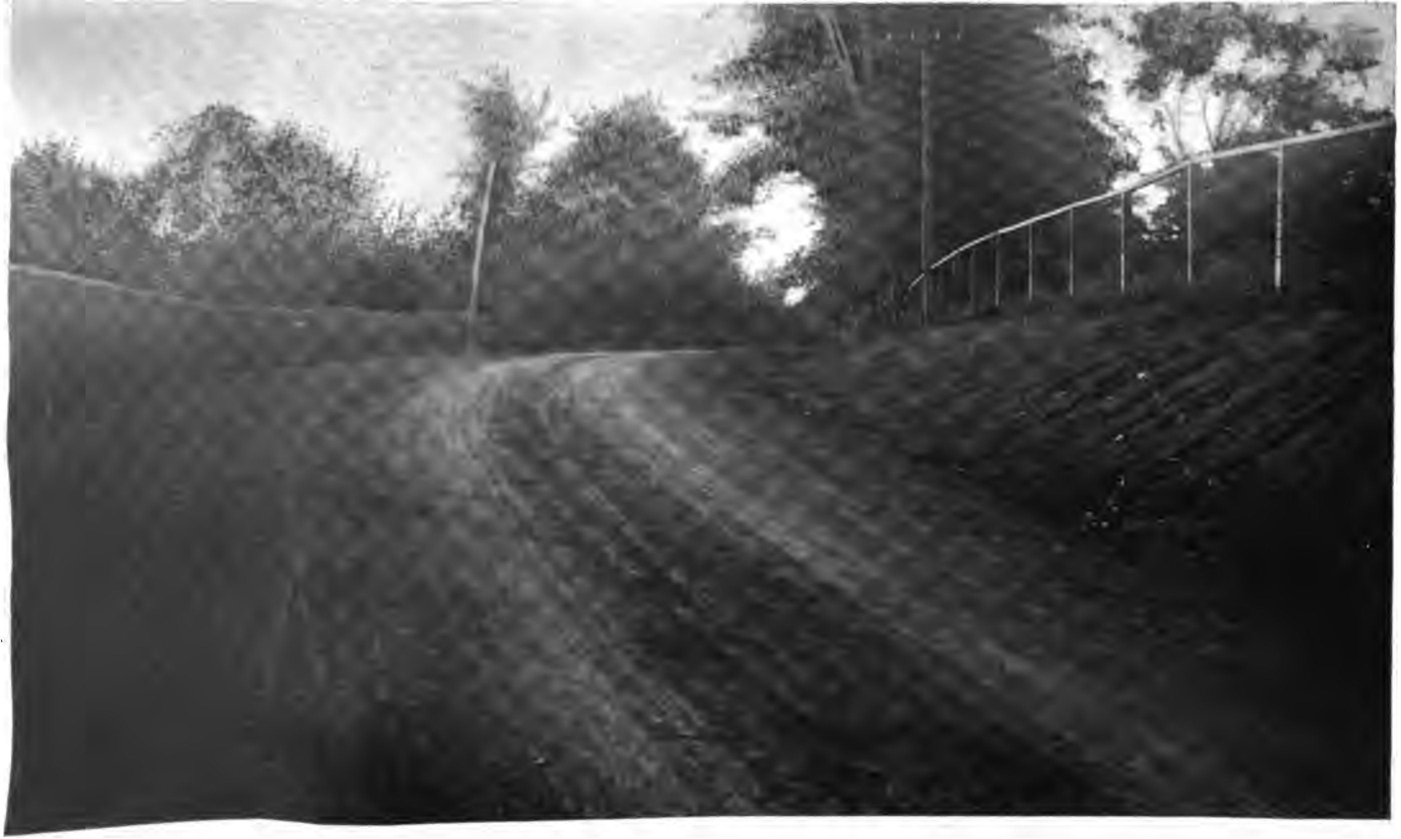
Road No. 3, known as the "Deerfield Road" located in Oneida county near Utica, leading east to the county line; length of road 2¼ miles; width of macadam surface 12 feet, formed of four inches of limestone base, covered with two inches of trap rock surface. Total cost of completed road $16,564 or $7,360 per mile.

Road No. 4, known as the "Lebanon and Pittsfield Road," located in Columbia county, leading southeast from Lebanon Springs to the Massachusetts State line where a new Massachusetts highway is built to meet it: Length of road 1.23 miles; width of metal 16 feet, formed of six inches of local gravel. Total cost of completed road $9,993, or $8,124 per mile. This includes $1,730 for a 40-foot bridge of steel on 20-foot abutments of



Troy and Schenectady Turnpike   Showing Culvert at Road Junction.

Troy and Schenectady Turnpike Finished Road.



Troy and Schenectady Turnpike   Finished Road.

masonry and also a culvert of 48-inch iron pipe; aside from these unusual features the cost per mile was $6,717.

This road departed from the line of the old highway which has been used since the country was settled nearly 100 years ago, and which had gradients of 17 per cent, 19 per cent and 20 per cent. The new location follows the contours of the hillside with maximum gradients of 5 per cent and on a line which is shorter than the old highway by 1,000 feet; this length being saved in 2¼ miles which includes the Massachusetts extension; thus furnishing a striking comparison between primitive and present methods of road location.

In addition to the completion of these roads in 1899, contracts have been let during 1899 for the following described roads, consisting of six highways located in three counties and aggregating 12 82-100 miles in length.

Road No. 5, known as the "East Avenue Road" located in Monroe county, near Rochester, leading from the village of Brighton to Fairport Junction; length of road 2.45 miles; width of macadam surface 12 feet, formed of four inches of limestone base covered with two inches of trap rock surface. The work on this road is in progress. Estimated cost about $5,350 per mile.

This width of 12 feet has been decided by the people locally interested to be too narrow, and they have arranged to make it 16 feet instead of 12 feet as provided in the contract.

Road No. 6, known as the "Little Ridge Road," located in Monroe county, leading west from Rochester through the town of Greece: length of road 6.53 miles; width of macadam surface 16 feet, formed of four inches of local sandstone base, covered with two inches of trap rock surface. The work on this road is in progress. Estimated cost about $5,962 per mile.

Road No. 8, known as the "Cortlandt Street Road," located in Onondaga county, leading south from Syracuse: length of road 1.2 miles; width of macadam surface 15 feet, formed of six inches of limestone base, covered with three inches of trap rock surface. Work on this road is in progress. Estimated cost about $10,460 per mile.

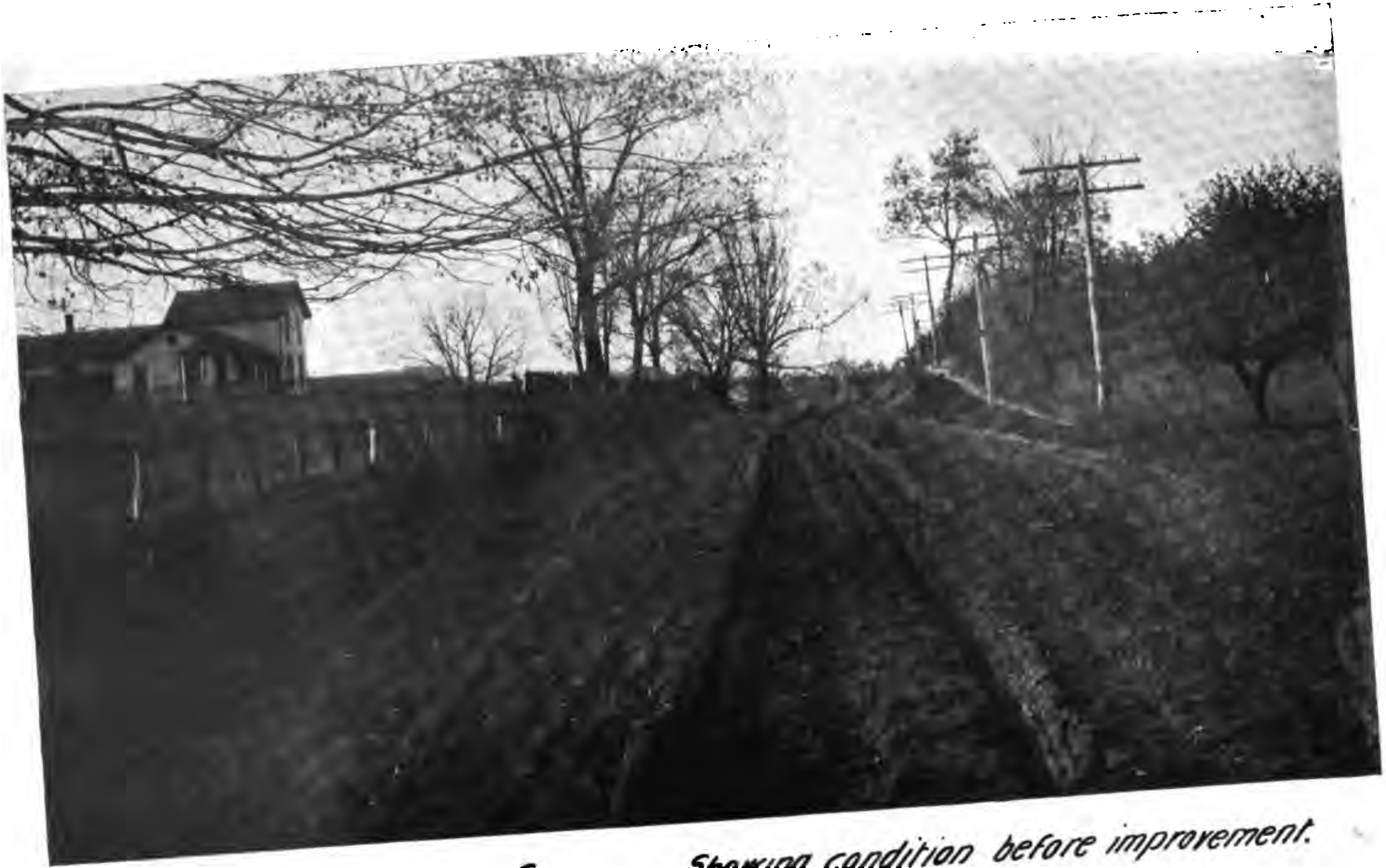
Road No. 9, known as the "James Street Road," located in Onondaga county, leading east from Syracuse to the village of East Syracuse: length of road 61.1000 of a mile; width of macadam surface 15 feet, formed of six inches of limestone base, covered with three inches of trap rock surface. Work on this road is in progress. Estimated cost about $12,824 per mile.

Road No. 10, known as the "Troy and Brunswick Road," located in Rensselaer county, leading northeast from Troy: length of road 1 mile; width of macadam surface 15 feet, formed of four inches of limestone base, covered with two inches of trap rock surface. Work on this road is in progress. Estimated cost about $7,254 per mile.

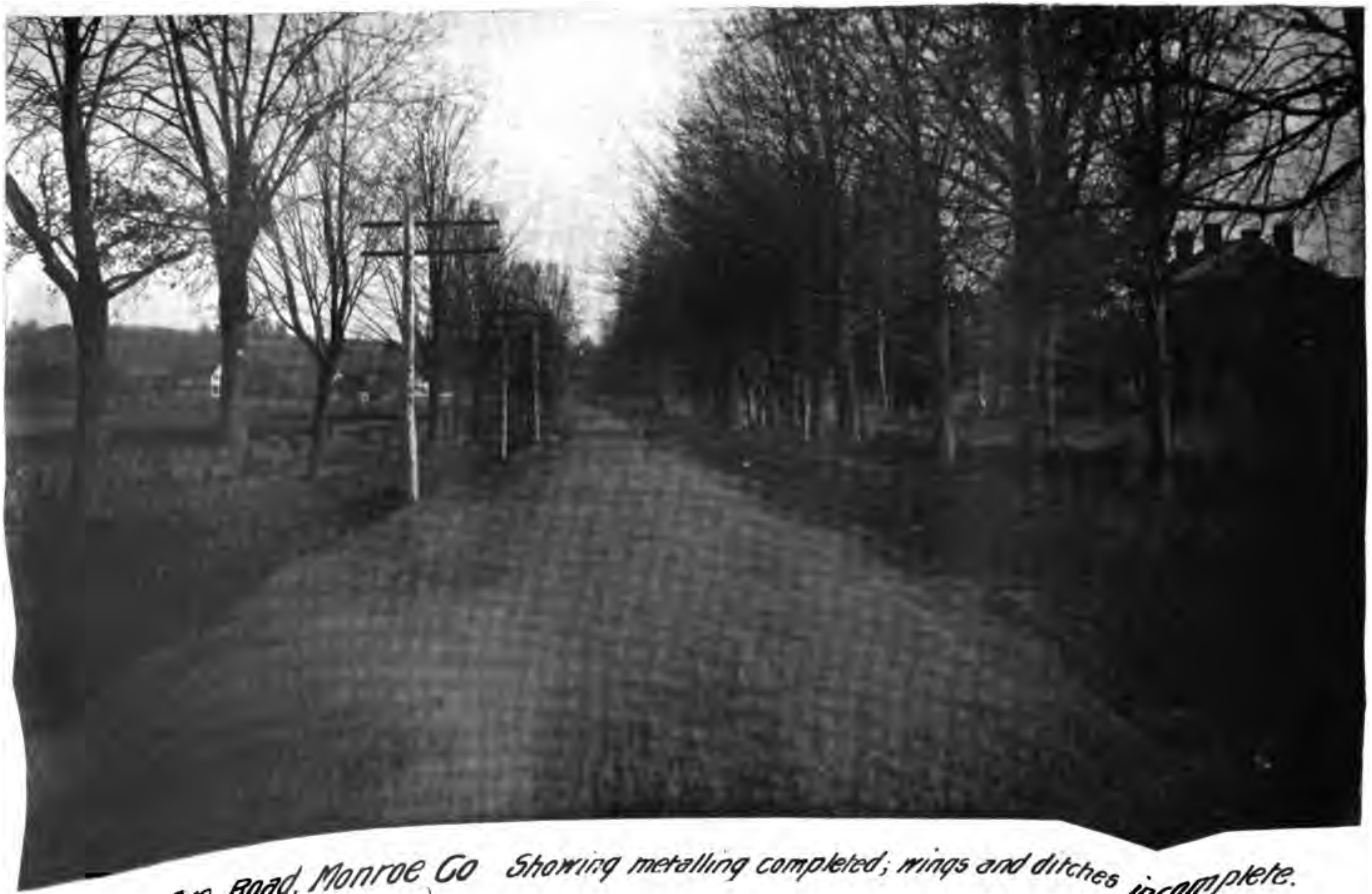
Road No. 11, known as the "Troy and Greenbush Road," located in Rensselaer County, leading southerly from Troy: length of road 1.03 miles; width of macadam surface 15 feet, formed of four inches of limestone base, covered with two inches of trap rock surface. Work on this road is in progress. Estimated cost about $9,546 per mile.

There are also described six highways located in six counties and aggregating 15 14-100 miles in length for which the contracts have been deferred for the reasons given as follows:

Road No. 7, known as the "Delaware Turnpike," located in Albany county, leading southwest to the town of Bethlehem; length of road 1.04 miles; width of macadam surface 16 feet,



East Ave. Road, Monroe Co. Showing condition before improvement.



East Ave. Road, Monroe Co. Showing metalling completed; wings and ditches incomplete.

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formed of four inches of limestone base, covered with two inches of trap rock surface.

The improvement of this road was ready for contract, but the matter has been delayed for acquisition of right of way by the Supervisors, which right of way is needed to complete the new line of road by which the old maximum grade of about 20 per cent. is avoided and the same rise is accomplished with maximum grade of five per cent. The estimated cost of this road, owing to difficulty in location, is $12,750 per mile.

Road No. 12, known as the "Waterford Road," located in Saratoga County, leading from Waterford north along the Hudson River: length of road 1.51 miles; width of macadam surface 16 feet, formed of four inches of local limestone, covered with two inches of trap rock surface. Plans and estimates were made for this road; and were approved by the Board of Supervisors but an error in the form of resolution prevented further action until the Board should again meet. Estimated cost about $8,047 per mile.

Road No. 13, known as the "Southport Road," located in Chemung County, leading south from the city of Elmira to the Pennsylvania State line: length of road 2.6 miles; width of macadam surface 16 feet, formed of four inches of limestone base, covered with two inches of trap rock surface.

Plans, estimates and specifications were made for this road and approved by the Supervisors; proposals were received in excess of the approved cost of the road and the contract has not been awarded. Estimated cost about $7,035 per mile.

Road No. 14, known as the "Frankfort and Utica Road," located in Herkimer county, leading west from the village of Frankfort: Length of road 1.11 miles; width of macadam surface 15 feet, formed of four inches of limestone base covered with two inches of trap rock surface. Estimated cost about $7,153 per mile. This has been approved by the board of supervisors, but the contract has not been made.

Road No. 15, known as "The Hudson Avenue Road," located in Monroe county, leading northeast from Rochester to the Big Ridge road: length of road 64-100 miles; width of macadam surface 16 feet, formed of four inches of limestone base, covered with two inches of trap rock surface. Estimated cost $11,774 per mile. This has been approved by the Board of Supervisors, but the contract has not been made.

Road known as the "Oswego West River Road," located in Oswego county, leading south from the city of Oswego to the village of Minetto; length of road 2.48 miles; width of macadam surface 16 feet, formed of four inches of limestone base, covered with two inches of trap rock surface. Estimated cost $8,760. The board of supervisors adjourned without taking action upon the subject.

As is shown above, some of the roads have been built with 12 feet width of macadam surface formed of six inches thickness of crushed limestone. Experience however shows that 15 feet or 16 feet are the least widths of macadam for highways having much travel. As the roads first selected for improvement are naturally the main highways of the region, these widths are the ones now generally adopted: It is also found to give best economy to use two inches of trap rock to form the surface of the macadam roadway, this being much more durable than some qualities of limestone. With these features, the average cost throughout the State will be between $8,000 and $9,000 per mile of completed highway, which is 20 per cent. below the cost of similar roads in Massachusetts.

In addition to the 16 roads above described, surveys have been made for 31 other roads located in eight counties and aggregating 131 miles, for which plans and specifications are in course of preparation: No more contracts will be made for road construction until another appropriation of money shall be made by the Legislature, as the contracts now in force will exhaust the funds which have been appropriated.

The information covering these various points will be shown in the following tables:

Petitions Received for Highway Improvement Under the Higbie-Armstrong Law from Date of Approval, March 12, 1898, to January 12, 1900.

Name of counties	Number of petitions for improving highways.	Length in miles.
Albany	3	7.04
Chenango	1	5.00
Chemung	2	4.60
Clinton	6	108.25
Columbia	1	1.25
Cortland	1	0.45
Deleware	2	12.00
Erie	8	59.54
Herkimer	4	19.68
Monroe	16	88.17
Montgomery	2	5.75
Oneida	4	9.50
Ontario	1	5.50
Onondaga	10	11.58
Orange	8	141.00
Orleans	1	2.25
Oswego	1	2.48

Name of counties.	Number of petitions for improving highways.	Length in miles.
Rensselaer	5	10.53
Rockland	11	19.50
St. Lawrence	1	3.50
Saratoga	5	23.00
Schenectady	6	9.32
Ulster	6	59.00
Westchester	16	68.00

24 counties, making 121 petitions for improving 676.89 miles.

Roads for which surveys, plans and estimates are made.

No.	NAME OF COUNTY.	Name and description of road.	Length in miles.	WIDTH IN FEET.		Max. grade in feet per 100.	MATERIAL PROPOSED.		Estimated cost per mile, including engineering.
				Between ditches.	Macadam roadway.		Inches thick after rolling.	Kind of stone.	
12	Saratoga	Waterford and Mechanicville road	1.51	22	16	2	2 4	Trap surface, local limestone base	$11,893
13	Chemung	Southport road	2.60	20	16	2½	2 4	Trap surface, local limestone base	7,035
7	Albany	Delaware turnpike	1.04	22	16	5	2 4	Trap surface, limestone base	12,750
..	Oswego	West Oswego River road	2.48	26	16	4	2 4	Trap surface, limestone or local sd	8,760
14	Herkimer	Frankfort and Utica	1.11	22	15	4	2 4	Trap surface, local base	7,155
..	Montgomery	Northampton road	0.70	22	12	3½	2 4	Trap surface, limestone base	5,879
15	Monroe	Hudson Ave. road	0.64	22	16	3 1/10	2 4	Trap surface, limestone base	11,774

Roads for Which Surveys Only Are Made.

COUNTY.	Name of Road and Description.	LENGTH IN MILES	
		Each Road.	Total in County.
Erie	River Road, N. from Buffalo to Gd. Is. ferry	1.00	1.00
Monroe	Monroe Ave. from Rochester east	4.30	4.30
Westchester	Hastings to Ardsley	1.00	
Westchester	Ardsley to Unionville Road	5.00	
(West side of Co.)	Unionville Rd. to McKeel's Corners	2.00	
(West side of Co.)	McK. Cor to Briar Cliff Manor	2.00	
(West side of Co.)	Briar Cliff Manor to Echo Lake	3.00	
(West side of Co.)	Echo Lake to Pines Bridge	3.00	
(West side of Co.)	Pines Bridge to Yorktown Hts	5.00	
(West side of Co.)	Yorktown Hts. to Putnam Co. Line	7.00	
Westchester	Mamaroneck to White Plains Rd.	2.00	
Westchester	White Plains to Armonk	7.00	
(East side of Co.)	Armonk to Mount Kisco	5.00	
(East side of Co.)	Mount Kisco to Bedford	4½	
(East side of Co.)	Bedford to Cross River	5.00	
(East side of Co.)	Cross River to Turk Hill Rd.	3.00	
(East side of Co.)	Turk Hill Rd. to Put. Co. Line	6.00	60½
	(Also 10 miles of alternative lines.)		
Orange	Newburg to Montgomery	10.00	
Orange	Montgomery to Walden	3.00	
Orange	Walden to Goshen	8.00	
Orange	Goshen to Warwick	10.00	
Orange	Chester to Goshen.	4.00	
Orange	Goshen to Middletown	5.00	
Orange	Middletown toward Unionville	5.00	45.00
	(Also 1 mile of alternative line)		
Clinton	Plattsburg & Rouses Point	2½	8.00
Clinton	Lake Shore Road	5½	
Ulster	Phonecia to T. L. of Olive	5.00	8.25
Ulster	Pine Hills to Shandaken	3¼	
Rockland	Nyack to West Nyack	2.00	2.00
Total miles			133$\frac{45}{100}$

These tables show that the average of the total costs per mile for the eight roads which have been built and are now building in New York State under the appropriations of 1898 and 1899, and which have a total length of 23 miles and an average width of macadam roadway of 14¼ feet, is $7,051 per mile.

The cost of macadam roads in the State of Massachusetts, as given on page 137 of the annual report for January, 1899, is $9,978 per mile, based upon a length of 175 miles, with an average of 15 feet width of macadam roadway. This lesser cost of road building in New York State is to be explained in part by the fact that there is no cost to the State for administration and direction of this work; the salaries of the State Engineer, the

Deputy State Engineer and the three division engineers being provided for in the appropriation for the State Engineer's Department; these officers, as well as the clerical force, performing the duties connected with the highway improvement in addition to their other duties, without extra pay.

For the Massachusetts roads, mentioned in the report for 1899, one-third of the roads only use trap rock for surface, there being local stone which has been considered good enough for two-thirds of the roads.

AIM IN ROAD BUILDING.

In road building the main object is to get the greatest length of the best road for the least money.

The best road will have the location which will give the best drainage and the easiest grades, and will serve the most traffic.

The best road will have the design and construction which will give a perfectly drained bed of dry earth, supporting a smooth and water-tight surface.

This will enable it,

to shed water with least delay;
to endure frost with least change;
to carry traffic with least wear;
to carry heaviest loads with least effort;
to carry light loads, speedily, with least jolt.

The best location and design of a road can only be made after a thorough survey and a careful location by a civil engineer who has had experience in designing and building roads.

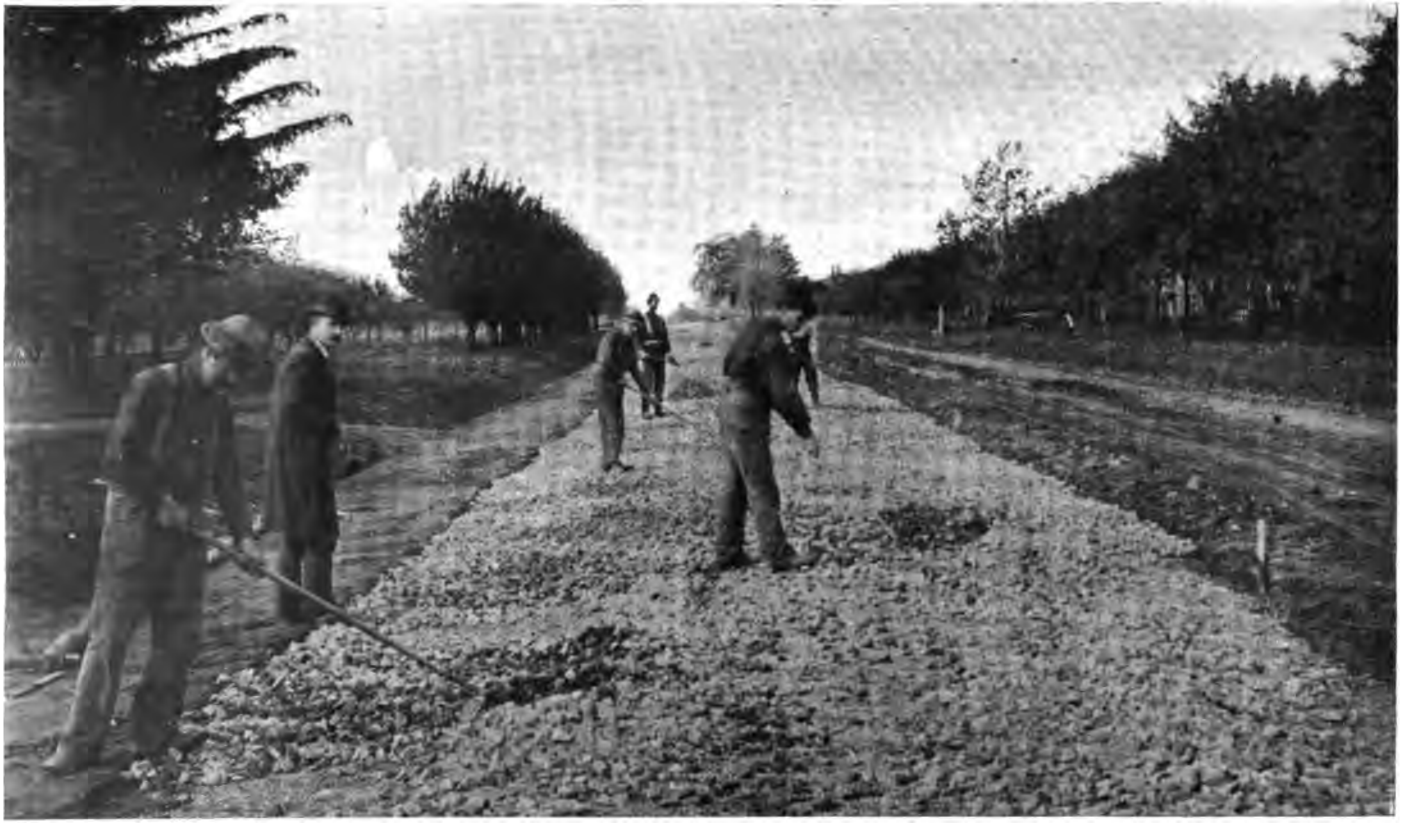
The best construction of a road can only be obtained under skillful supervision, by correct formation of the drains and of the roadbed, and by careful selection of the proper materials and by close and constant attention to the manner in which these materials are prepared, placed and consolidated.

SKILLED ROAD BUILDERS.

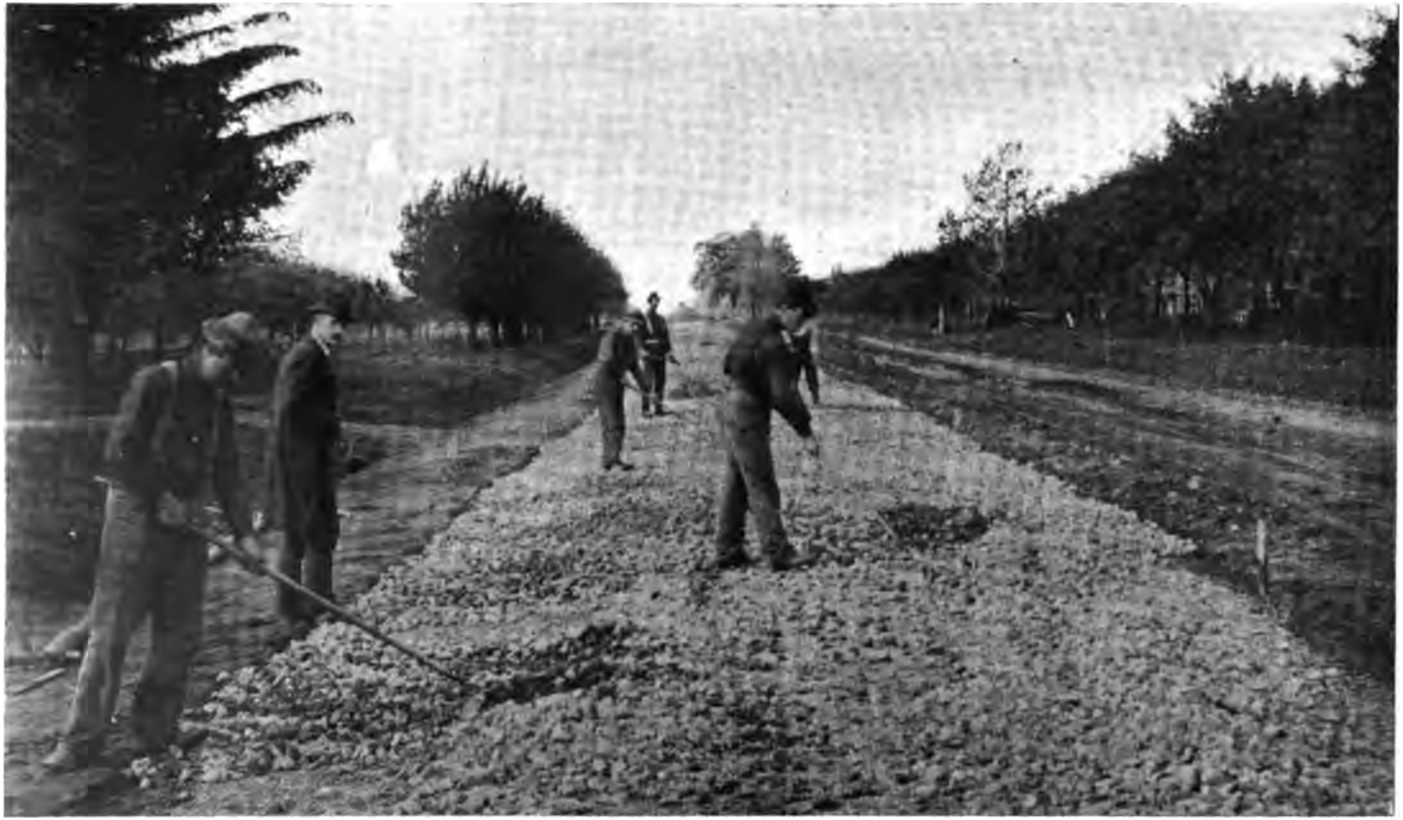
The engineer in charge of building a road must also know how to successfully meet any conditions which may develop during the progress of the work and must be able to direct how to correctly deal with deposits of loose sand, pockets of soft clay, sliding banks, damage from heavy rains and other natural difficulties, some of which may appear daily and must be promptly overcome.

The subgrade must be made uniformly hard and true, and any soft spots which are found must be corrected. The ditches must be even so that water will flow in them. The crushed stone must be uniform in size, and must be evenly spread and rolled. The screenings must be properly worked in to serve as binder by the use of brooms, of water and of the steam roller. The roller must be handled so as to detect soft spots if they exist, and to form the crown and preserve the grades, rolling first along the edges and lapping a few inches into the wings, and rolling last along the center until the fragments of stone are consolidated as much as possible and the remaining voids are filled with the screenings.

To do all this well, the engineer must have a natural aptitude for the work, an appreciation of the importance of each one of its many details, and a readiness to receive orders and enforce them. He must have good judgment in directing the contractor and tact in managing the work so that the people who live along the road shall be least inconvenienced during its construction, and that the cycle path which usually runs beside it shall be least disturbed; for an improved road must be made a source of satisfaction and of local pride to the people using it.



Ridge Road, Monroe Co. Spreading Trap rock; Foundation shows in left foreground



Ridge Road, Monroe Co. Spreading Trap rock; Foundation shows in left foreground

The engineer who has these qualifications for a road builder is exceptional, and he must also have the experience which can only be obtained by observing road-building in actual progress under various conditions.

It is, therefore, necessary to select the proper men from those who are available and to have them train others for the work, which can best be done, in the climate of New York State, during the six months between May first and November first.

CONTRACT FOR ROAD BUILDING.

In order to make a contract for building such a road, all of these general features and particular details must be fully shown upon the drawings and fully described in the specifications. These surveys, drawings and specifications will generally cost about $100 per mile of road, and they are so arranged that an experienced contractor may know precisely what he will have to do, and can name a lump sum for the completed road including all the materials and labor, with no need to provide a margin for uncertainties. Lump sum bids have thus been obtained on all the improved highways now in progress.

The lowest rates will be obtained when large amounts of work are in progress so that the contractors can have a good supply of proper road machinery which they can use on a succession of works in the same vicinity.

The small and widely distributed roads, which have thus far been built in New York State, necessarily cost more per mile than they would if the work were done on a larger scale.

These roads have necessarily been built by contractors having little or no previous experience in such work, so that the time of construction has been unduly long, and the cost of supervision proportionately increased.

TESTS OF ROAD MATERIAL.

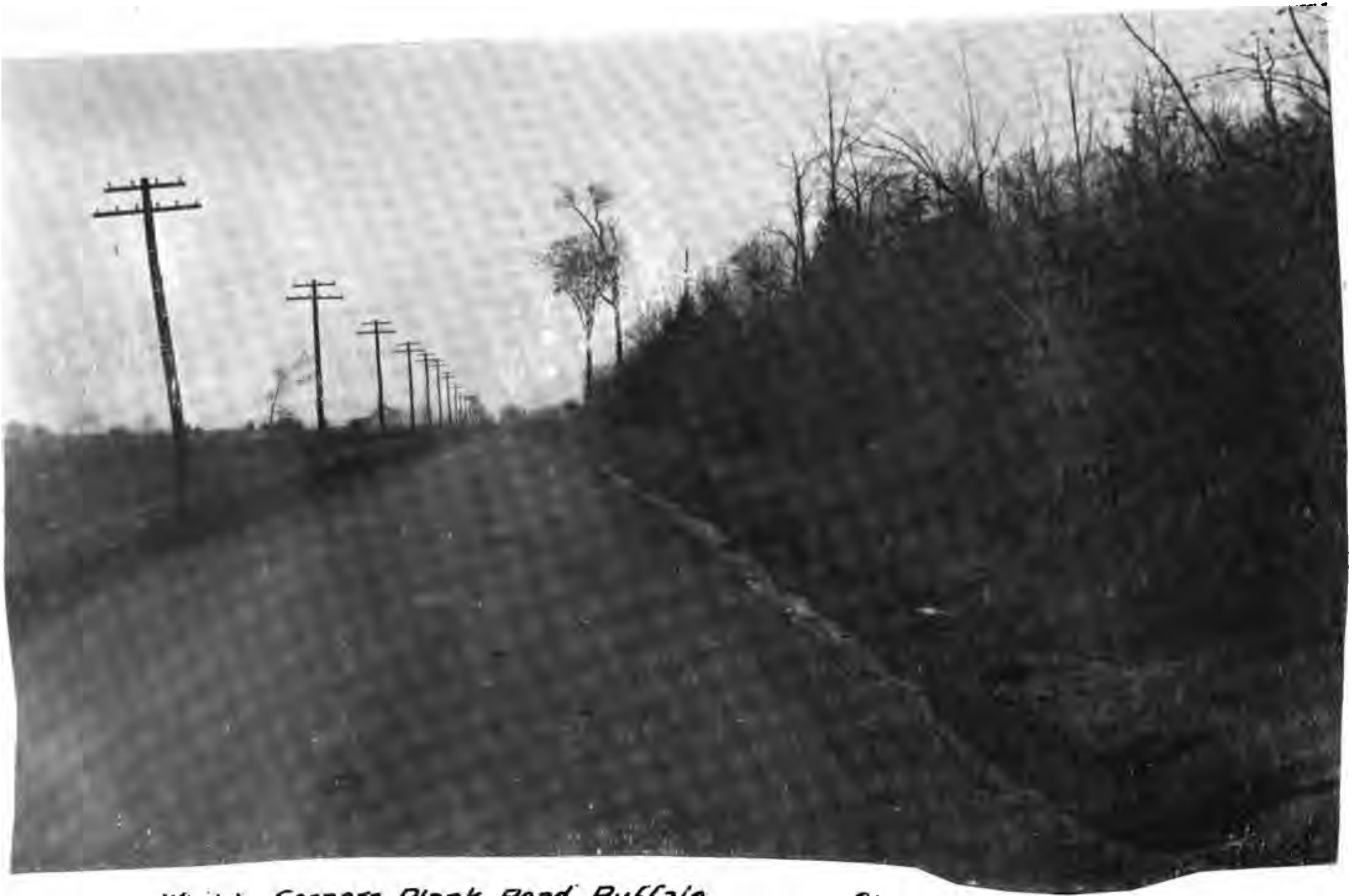
Comparative tests can be made of the various rocks found near the proposed roads in different parts of the State, and it is proposed to install in the cement-testing room of this department, the latest improved appliances for making such tests by which the best material may be selected.

County authorities desiring to build their own roads can have the proposed stone tested free of expense, instead of building roads and finding too late that the material was unfit.

The crushed rock and screenings will be consolidated in forms one foot square and as deep as the actual proposed roadway, enabling their cementing qualities to be thus observed and compared.

The wearing qualities of the various kinds of rock will be determined in an abrading machine, which will show the relative wear of each when all are subjected to precisely the same treatment and thus enable the State Engineer to determine which of the different rocks in each county will give the best results. Three-quarters of the roads constucted in this State up to the present time require trap-rock surface—no suitable local stone having been found. Much of the stone throughout New York State is entirely unsuited for permanent road building; some of the limestone being too soft for the purpose, while much of the sandstone is too brittle and friable and has no binding properties.

If the State is to build roads on a large scale, it would seem that some means might be devised to produce more cheaply the necessary crushed trap-rock by employing convicts to quarry and crush it.



White's Corners Plank Road, Buffalo. Showing completed road.

PRISON LABOR.

The principal formation of trap-rock in New York State, exists in Rockland county just across the Hudson river from Sing Sing prison, where a large number of convicts are confined in idleness, which is injurious to them and expensive to the State. It would seem practicable that the State should open a quarry in the trap-rock formation near Sing Sing, at a point back from the river, where the picturesque features of the Palisades should in no wise be affected by it, and should equip this quarry with stone-crushing machinery. The convicts could here be confined as securely as in Sing Sing, and the crushed rock delivered at the wharf on the Hudson river, at about one-third the price now charged by private quarries along the Hudson river in New Jersey. Contracts for highway improvement could be let with the stipulation that the contractor could obtain the necessary stone at a certain fixed price per cubic yard at the State wharf, where it could be loaded onto canal boats for cheap transportation to any part of the State reached by the canal system.

For such localities as could only be reached by railroad transportation, special freight rates could doubtless be arranged with railroad companies, since railroads profit directly by the improvement in highways, all of which are direct tributaries to the railroads and bring to them business which is created by the existence of good highways.

The question of the profitable employment of convict labor in building roads has received much attention, and many discussions for and against it have been printed. Such an arrangement as is here suggested seems to avoid the objections, since the prisoners can be confined as closely as within the walls of

Sing Sing prison, and when working will not compete in any way with organized labor.

The counties wishing to reduce the cost of improving their highways can employ upon the work of drainage and of grading, the prisoners confined in idleness in the county jails, which are now sought by the criminal class as a welcome retreat where they can be cared for at the cost of the taxpayers. Fifteen hundred men are thus confined, many of whom can be usefully employed in improving the highways.

These prisoners could be employed to prepare the roads so that the contract for macadamizing could be let at a less cost to contractors who have the road building machinery necessary to go on and complete the work. Or the counties or towns could supply themselves with the needful outfit of steam rollers, wheeled scrapers, sprinklers, and spreader wagons and could take the contract for building and completing the road under the direction of the skilled roadbuilders of the State Engineer's Department.

No close estimate can be made as to the actual value of the services of such prisoners. Various plans have been tried in some counties of this State and in some other States with varied results. The reports from North Carolina indicate a large saving and good results.

CEMENT TESTING FOR STATE AND MUNICIPAL WORKS.

The testing of all hydraulic cements used in the masonry of State canals and bridges has long been done by this Department, and no contractor for State work is allowed to use any cement until it has been tested and approved. As soon as cement has been delivered and stored at the proposed works, samples are taken by the engineer in local charge and are forwarded to the State Engineer's office in Albany, where they are subjected to the various tests required by the rules adopted by the American Society of Civil Engineers. If found to be equal to the standard prescribed by the specifications, after seven days of test, the engineer in charge is notified of the acceptance. In many cases the cement proves deficient and is rejected.

The tests are now more needed than formerly because it is a well-known fact that many manufacturers of cement make various grades, and that only the best grades are sent to those purchasers who are apt to test them, the inferior grades going to those places where no tests are expected.

The tests made in the State Engineer's office are conducted by a skilled expert of long experience, and their impartiality and reliability are recognized and accepted by other departments of the State government for whom, during the past month, 116 tests of 22 lots have been made, of which three lots were rejected.

The municipal officials of New York State are also to have the free benefit of these facilities, and notice has been given to all city and county engineers that any cement for use in municipal works will be tested at the office of the State Engineer in Albany, and that the results of such tests will be promptly furnished under the seal of the State Engineer free of all charges of any kind.

Few city engineers have the time to make such tests, even if they have the appliances and experince which are needed to obtain reliable results, and it is thought that this extension of the system will benefit the public works of many cities of the State.

SURVEY OF LAND FOR CORNELL COLLEGE OF FORESTRY.

Provision was made for a College of Forestry by chapter 22 of the Laws of 1898, entitled "An act to promote education in forestry, to encourage and provide for the establishment of a college of forestry at Cornell University, and making an appropriation therefor."

Under this act a tract of 30,000 acres was purchased for this purpose by the State from the Santa Clara Lumber Co. in townships 23 and 26 of Franklin county, lying west and south of parts of Upper and Middle Saranac lakes.

The tract was defined in part by old boundary lines run in 1799 and marked by blazed trees, and in part by the Raquette river and in part by the old township lines.

Under section 3 of this act a party was organized to run these lines, and computations were then made to determine the exact location of the south limit which should include this 30,000 acres desired.

This survey was begun on July 24, 1899, the old lines being retraced for the party by Mr. H. S. Meekham, a local surveyor familiar with them and with their history and having the confidence of the various parties concerned. The survey was completed on October 7, 1899, and it was found that the amount of land owned by the Santa Clara Lumber Co. in the two townships above mentioned lacked 285.34 acres of the requisite amount (assuming the south line of their land to be the line run by Benj. Wright, in 1799-1800, for the south line of Township 26), thus making only 29,714.66 acres as the area of the reservation. Negotiations are now in progress for a refund to the State of the money paid for the 285.34 acres found lacking by the survey.

COURT OF CLAIMS SURVEYS.

Many surveys have been made during the past year of various localities along the canals where claims have been made for damages alleged to have been received by reason of the canal and its work. These surveys and maps and photographs and the testimony of the engineers in charge have enabled the court of claims to set aside and disallow claims which aggregate, in one set of cases alone, more than the total cost of the State Engineer's Department for the entire year.

A more detailed description of this work will be found in the reports of the division engineers' accompanying this report.

OYSTER BED SURVEYS.

The work of surveying and mapping lands under water of the State of New York for shell fish culture and preparing necessary papers connected therewith, under this Department and direction of the shell fish commissioner, Hon. Edward Thompson, has been in continuation and pursuance of the oyster surveys initiated by the Hon. Eugene Blackford in 1817 and carried on by Mr. Thompson for the past five years.

During the past nine years great advances have been made in the methods used in the oyster industry. To increase the oyster supply new grounds are constantly being brought into use which before lay dormant and of little use to the State or people.

During the past year forty-two applications have been received for oyster grounds, covering thirteen hundred and three acres, located in Long Island Sound, Raritan Bay and Jamaica Bay, but principally in the latter waters. This shows an advance in the acreage applied-for over the fiscal year ending October 1, 1898, which was eleven hundred and forty acres. These applications have been granted to the applicants after advertisement. And the grounds have been duly surveyed.

It has been found necessary to repair many signals along the cost lines of Long Island Sound and Jamaica Bay and other localities, and to replace many which had disappeared altogether.

As there are many signals along the coast lines of Long Island Sound, Staten Island and Jamaica Bay, covering one hundred and eighty miles linear, I would recommend a sufficient appropriation to maintain the same and thereby preserve the thousands of recorded references thereto determining the corners of other thousands of oyster lots. And also for the determination of, and the building of suitable boundary marks, or buoys, on the boundary line between the States of New York and New Jersey, in Raritan Bay. Thus eliminating the present unpleasant feeling between the oystermen of New York and New Jersey.

LAND DEPARTMENT.

The subjects of the sale of State lands and of the granting of lands under water, and of the custody and care of the records of ancient surveys of lands are fully treated in the following report of Mr. Henry C. Parsons:

STATE OF NEW YORK:

OFFICE OF STATE ENGINEER AND SURVEYOR,
ALBANY, *December* 6, 1899.

HON. EDWARD A. BOND, *State Engineer and Surveyor:*

Sir.—I have the honor of herewith presenting to you a report on the various matters pertaining to the Land Department of your office for the fiscal year ending September 30, 1899.

During the year the State Engineer has had referred to him by the Commissioners of the Land Office—of which board he is a member by a provision of the Constitution of the State—for his examination and report, many matters of various kinds, such as applications to purchase lands, lands under water and other miscellaneous applications.

Fifty applications for lands under water have been received and considered during the year. Of these, eight were for purposes of commerce and forty-two for beneficial enjoyment.

In two cases the applicants were railroad companies, and in the remaining cases the applicants were riparian owners—either individuals or cities represented by their officers. Such applications are examined by the State Engineer to determine whether or not any interests of the State might be injured by the making of the grants asked for—that the maps and descriptions are properly made—that navigation would not be interfered with, and for any other objectionable features that might appear. It frequently happens that a personal visit to the premises applied is advisable to fix the lines of the proposed grant, or to fully satisfy himself that he can report that the grant would be a proper one to make. Twenty of the applications were contested by the authorities of the cities or villages where the lands are situated or by persons claiming ownership to the riparian lands, or by other interested persons.

The number of contested cases has been unprecedently large and has involved in the hearing and determining of such cases much additional labor and time.

The lands under water applied for are situated in seventeen counties, distributed as follows: Columbia, 5; Erie, 3; Greene, 1; Kings, 9; New York, 1; Nassau, 3; Orange, 1; Putnam, 1; Queens, 9; Rensselaer, 1; Richmond, 2; Rockland, 4; Suffolk, 1; Saratoga, 1; Ulster, 2; Westchester, 5; Wayne, 1.

Maps are now being made in this Department for the use of the State Engineer and Surveyor and the Commissioners of the Land Office, which will show the lands under water, adjacent to the shores of Westchester county, which have been granted by the commissioners, and those maps when completed will undoubtedly prove to be of as great value as the present and similar maps showing the lands under water granted in the counties of Kings and Richmond, which latter maps are kept complete by having the grants shown thereon as they are made from time to time. Under resolutions of the Commissioners of the Land Office the State Engineer has sold at public sale seventy-four parcels of land, for which the sum of $6,327.75 has been received.

Those lands are located in seven counties as follows: Clinton, 1; Richmond, 25; Albany, 1; Kings, 27; Niagara, 4; Rockland, 13, and Chautauqua, 3.

Nearly all of these lands were sold to the former owners for their cost to the State, at the times of the sales. And as the lands were acquired by the State in most cases through tax sales for the amount of taxes due at that time, it follows that the amounts received for the State's title at the sales held by the State Engineer are not much in excess of the amount of taxes and do not represent the actual value of the lands.

In addition to those sales there have been made resales of seventy parcels of lands for the sum of $30,813.74. These lands are all located within the limits of the Forest Preserve and were in every case purchased for the State; they are distributed among ten counties, as follows:

Name of county.	No. of parcels.	Area (in acres).	Amount sold for.
Clinton	5	375.20	$958 05
Essex	15	2,105	5,074 56
Franklin	7	1,220	2,850 12
Fulton	2	167.85	1,007 36
Greene	1	124	379 21
Hamilton	13	2,555	8,901 04
Oneida	8	*688	3,693 17
Ulster	1	225.6	713 99
Warren	12	1,839.5	5,537 39
Washington	6	903	1,698 85
Total	70	10,203.15	$30,813 74

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* Approximated.

There has been the usual amount of correspondence and answering of inquiries from surveyors, lawyers and others on matters pertaining to the original maps and descriptions of the colonial and early State surveys filed in this office. The answering of such inquiries often requires much time and study owing to there frequently being several surveys of the same tracts of lands made at different times by various surveyors and the evident importance that none should be overlooked.

The maps and records are becoming more and more valuable as in many instances the original surveys are of large parts of the State and particularly in the Adirondack region, where the lands have rapidly increased in value and where the State has in very recent years acquired title to many thousands of acres.

A large part of these records are very old and describe lines of tracts of lands which have become in many instances the boundaries of towns and counties, and thus the value of those records become of still greater value. After many years of use and frequent handling many of the land papers become much worn, and it was deemed best that they should be rearranged, placed in bound volumes and carefully indexed not only for the convenience of reference but for their better preservation. The work of indexing and preserving those papers is now steadily progressing. That it is the proper method for the care of those valuable papers, and that it affords greater facility of finding particular papers with the certainty that none have been overlooked, has already been fully demonstrated.

Very respectfully,
HENRY C. PARSONS,
Assistant Engineer.

BRIDGE DESIGNER AND INSPECTOR.

The subject of the design and inspection of bridges is fully covered by the report of Mr. Wm. R. Davis which follows:

September 30, 1899.

Hon. EDWARD A. BOND, *State Engineer and Surveyor:*

Dear Sir.—I have the honor as Chief Bridge Designer and Inspector under the State Engineer and Surveyor to report as follows for the fiscal year ending September 30, 1899:

Chapter 476 of the Laws of 1899 provided for the appointment, by the State Engineer and Surveyor, of a chief designer and inspector of bridges and the necessary assistant designers and draftsmen, whose duty it should be to design and inspect all bridges built or to be built under the supervision of the State Engineer and Surveyor.

Previous to 1899 plans for bridges to be constructed under the supervision of the State Engineer and Surveyor had been prepared by different engineering and bridge contracting firms. There were some objectionable features to this method, however; one being the criticism as to undue advantage which it was claimed the firm preparing the design and plans for a bridge, had over competing bidders when the proposals for the work were called for. Another objection was the lack of uniformity which naturally ensued; and also the disadvantage under which the Department labored, owing to the lack of data connected with the details of the various structures which is of more special importance in connection with the keeping in repair of some of the large lift-bridges of modern design, erected in the cities along the line of the Erie canal. The thorough familiarity which the Department would gain in regard to the 700 or 800 structures crossing the Erie, Champlain and Oswego canals, with the work, both of designing and inspection, brought under one head, it is my belief will prove very beneficial, both in the construction of the new work and also in the matter of repairs to existing structures.

The duties of the Chief Bridge Designer began upon July 24, 1899. The first ten days or more were devoted to an inspection of bridges and bridge sites in Utica, Syracuse, Rochester, Buffalo and elsewhere with the purpose of becoming somewhat acquainted with existing structures, the special features to be considered in the design of new bridges over the canals and the difficulties that have in the past attended the construction and operation of the various lift bridges.

Early in August, the lift bridge over the Erie canal at South Salina street in Syracuse was very carefully examined. This bridge could not then be operated successfully and had given more or less trouble since its completion in 1898. Several remedies had been already tried without success. Endeavor was made to work in harmony with the Superintendent of Public Works to the end that the bridge, which is on the principal business street in Syracuse, might be operated until the close of navigation without interfering with the traffic as would have been done had extensive repairs then been made. As a result, the bridge has since been operated with perfect satisfaction. After the close of navigation the important repairs and alterations needed can be completed without any interruption of traffic.

During the month of August the force consisted of the chief bridge designer and one engineering draftsman. During September it consisted of the chief bridge designer, one assistant engineer and one engineering draftsman. The work of organizing this branch of work in the State Engineer's office is steadily progressing and it will soon be necessary to increase the force.

The short time that has elapsed since July 24th and the small force employed have limited necessarily the work so far accomplished.

Considerable time has been taken for the careful study of the designs of existing bridges and of various arrangements of the machinery for swing and lift bridges, comparing advantages and disadvantages, in order to simplify and systematize the work as much as possible.

The plans on a new design for a lift-bridge over the Erie canal at Chapel street, Lockport, are nearing completion and these will soon be followed by plans for a lift bridge over the Erie canal at Catherine and Almond streets, Syracuse.

Several reports of Mr. Chas. F. Stowell, C. E., upon bridges to be used or constructed by trolley companies over the canals, have been examined.

The bridge over the canal of the Niagara Falls Hydraulic Power and Manufacturing Co. at Main street Niagara Falls, has been carefully inspected and found to be constructed in accordance with plans that had been previously approved by the State Enginer and Surveyor.

In view of the facts relating to the water supply as set forth in the annual reports for 1891 and 1897 of Mr. Emil Kuichling, chief engineer of water works of Rochester, and the accompanying recommendations, it seems very desirable to adopt some other than hydraulic power (now used there exclusively) for any lift bridges that may hereafter be built in the city of Rochester. This may also prove true in other cities. The past few years have seen electrical machinery and appliances so perfected that electricity is steadily gaining in favor as a motive power. It is now reliable, economical and adaptable to almost every service where mechanical power is required. None of the lift bridges on the canal are at present operated by electricity. The questions of comparative costs of operation and equipment for hydraulic and electric powers will be thoroughly taken up as soon as possible, and the details required for the successful working of a lift bridge by electricity will be carefuly studied.

The vexatious and expensive failures that have in the past often attended the construction and operation of lift bridges can be avoided in the future by thorough and conscientious study of the details of design, attended hand in hand with vigorous inspection to the end that the designs be faithfully followed in construction. In the past the designing engineer had no part in the construction; his services ended when the plans were delivered. It is justly due those who have designed existing structures to point out that some have been pioneers in the introduction of original types of great merit. The designs of Mr. George P. Hilton particularly deserve mention. The fact that further improvement is possible and will be made ought not in the least to detract from the credit due him.

Respectfully submitted,
WM. R. DAVIS,
Chief Bridge Designer and Inspector.

GEOLOGICAL SURVEY REPORT.

UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C., *December* 19, 1899.

HON. EDWARD A. BOND, *State Engineer and Surveyor, Albany, N. Y.:*

Sir.—I have the honor to make herewith a preliminary statement of the work done under the agreement signed March 25, 1899, by you on behalf of the State of New York, and by me on behalf of the United States Geological Survey. This includes a final statement of the work done under the agreement signed between your predecessor and myself and dated April 14, 1898.

By the terms of the agreement signed this year, $20,000 was allotted by you for expenditure in making the co-operative topographic survey therein provided for. In addition, there remained at the beginning of the field season an unexpended balance of the State appropriation of 1898 amounting to $2,964.56, making thus a total of $22,964.56 of State funds available for this co-operative survey. This bureau has, under the terms of the agreement, allotted $20,000 to this work, and in addition, there remained an unexpended balance of our allotment of 1898 amounting to $4,818.84, making thus a total allotment from this bureau for field work in 1899 of $24,818.84.

Accordingly, there was available for topographic surveys within the State of New York during the field season of 1899 a total of the State funds of $22,964.56 and of the Federal funds of $24,818.84, or in all $47,783.40.

The net results in field work from the expenditure provided under this agreement has been the making of an accurate trigonometric survey for the control of future topographic field work over an area of 1,540 square miles, at an expenditure of $2,030 for field work only, or at an average rate of $1.32 per square mile. This triangulation furnishes control for the mapping of nine atlas sheets. One of these is to the north of Saratoga, six are in central New York to the south of Rochester, and two are in the neighborhood of Corning. A line of precise levels was run from a bench mark established in Schenectady in the course of precise leveling of the previous year northward via the line of the Delaware and Hudson Railway to North creek. There were 81 miles of such levels run, in the course of which 12 permanent bench marks of bronze or aluminum were established, and the positions of many other points accurately determined. The total cost of this precise leveling was $450, including salaries, or at the average rate of $5.62 per mile run.

In addition to the above work for the primary control of these surveys, there has resulted from the field operations of the past season a complete and accurate map on a scale of 1:62500, or approximately one mile to one inch, and with a contour interval of 20 feet, of 3,308 square miles, all within the borders of the State. The results of these surveys will be published on fifteen separate atlas sheets generally distributed through sixteen different counties. In addition, seven other atlas sheets, covering 1,370 square miles, were partially surveyed, the total number of counties in which surveys were prosecuted being twenty-seven.

For those portions for which the surveys were completed, the average rate of expenditure was approximately $7.80 per square mile, a sum which averages $1.14 less per mile than the field work of the preceding season.

The total cost of all of the above work, including topographic surveys, primary triangulation and precise leveling, and including also estimated expenses for the platting and drafting of the maps and the computation of trigonometric positions in the office during the coming winter, is $38,600. It is impossible to give an average rate per mile, as the above includes in addition to control the work done on a number of partially surveyed sheets. The average cost of all the topographic surveying, including expenditures on all accounts, within the area of the State since the inception of this work has been to date $11.30 per square mile. Of the total sum expended in 1899, namely, $30,985, about $16,385 have been expended by the State and $14,600 by this bureau. The greater portion of the remainder which is estimated towards office expenses, namely $4,400, will be expended by this bureau in the prosecution of office work.

As the total joint allotment to this work was $47,783.40, there will remain a balance of State and Federal money at the beginning of the next field season in the spring of 1900, approximating $9,180. This sum will be devoted, as in the past spring, to the early inauguration of field work in the State.

In accordance with suggestions heretofore submitted by you, I have therefore to recommend that this sum be devoted, first, to the completion of field work on Penn Yan, Canandaigua, Hammondsport, Richfield Springs, Berne, Luzerne and Blue Mountain Sheets, and that the balance be devoted to the extension of primary triangulation to the westward of Mt. Marcy and Old Forge in the Adirondacks, also to the extension of triangulation in northern Chenango and eastern Delaware counties; also to the extension of topographic mapping to the westward of Durham and Kaaterskill sheets in the Catskills and in such other localities as you may hereafter designate.

Very respectfully,
CHAS. D. WALCOTT,
Director.

TOPOGRAPHIC SURVEY OF THE STATE.

Chapter 96 of the general laws of 1899 authorized the State Engineer and Surveyor to continue to co-operate with the director of the United States Geological Survey in making a topographic survey and map of the State of New York, and appropriated for this work the sum of $20,000. This was, unfortunately, $5,000 less than the amount appropriated for the same work by the preceding Legislature, and as a result there has been a corresponding falling off in the amount of the output. In addition to this $20,000, there remained available for field work in the early spring months of 1899 a balance of $2,964.56 from the appropriation of 1898, which was unexpended in order that it might be more economically used during the spring season of this year. As a result, the total amount of $22,964.56 of State funds was available for the making of topographic surveys during the season of 1899.

In accordance with the provisions of this law, as of its predecessors, an agreement was signed by the Hon. Charles D. Walcott, Director of the United States Geological Survey, and myself, which was similar in all essential details to those made in former years between the two contracting parties. In accordance therewith the Federal Survey allotted to this work the sum of $24,818.84, approximately $1,850 more than the sum allotted by the State. Accordingly, there was available for topographic surveys within the State of New York during the season 1899 the total sum of $47,783.40.

Upon assuming charge of my office I deemed it incumbent upon me to inquire thoroughly into the antecedent operations of this topographic survey before committing myself to a recommendation for its continuance. Representations were at once made to me, both from its friends and those who opposed it, but I soon discovered that there was a great preponderance of reliable opinion in favor, not only of its continued prosecution on the lines already adopted, but for the making of even larger expenditures in the making of the surveys. I was soon convinced that the work was being economically performed and with all reasonable expedition. I take pleasure in heartily recommending the continuance of the present arrangements, as the field work is conducted under the supervision of Federal officers well acquainted with the demands of the work, and in such manner as to involve the least amount of personal attention and time of the office of the State Engineer and Surveyor. Not only is the field work executed with reasonable accuracy and speed for the outlay, but the results are promptly placed before the public in the form of maps handsomely engraved at no additional cost to the State and yet available to the public at a nominal price.

During the past field season primary triangulation was extended over an area of 1,980 square miles by the occupying of twenty stations, the exact positions of which have been determined. This area is distributed through the counties of Saratoga, Warren, Fulton, Ontario, Livingston, Yates and Steuben. Hereto I append descriptions and positions of primary triangulation stations located in the prosecution of this work during the previous field season of 1898. Those determined during the field season of 1899 will be published in my next annual, after the positions have been computed in office.

A line of precise levels was extended from Redhouse near Salamanca southwestward to the State line near Onoville; where it connected with the precise levels from Pittsburg, Pa.; also from Schenectady via Saratoga to Northcreek for the adjustment of the primary leveling in the Adirondacks. In addition there were run 2,278 miles of engineering spirit levels for the reduction of the topographic mapping to mean sea level. In another appendix submitted herewith is a list of the bench marks established during the field season of 1898 and not published in the last annual of this office pending the reduction to mean sea level. Following that is a list of such of the levels run during the past field season, that of 1899, as have been so reduced.

Topographic mapping was completed for fifteen separate atlas sheets distributed through sixteen different counties. In addition seven other atlas sheets covering portions of sixteen counties were partly mapped. In all 3,308 square miles of the area of the State were finally mapped during the season and the equivalent of about 1,370 square miles were partly surveyed. The detailed results are given in another part of this report.

PLANS.

The field work of this survey was resumed as early in spring as the conditions of the weather and roads permitted. The balance of the funds available from the appropriation of the preceding year permitted this to be taken up even before the Legislature had appropriated for its continuance. Prior to the inception of field work, however, plans were arranged in consultation with Mr. H. M. Wilson, Geographer of the United States Geological Survey, in charge of field work in this region, in accordance with which it was decided to continue immediately field work for the survey of those portions of the State which provide water supply to the various feeders of the Erie canal; also for the continuance of surveys in the Adirondack region, with a view not only of affording data for the study of water supply, but also to aid the deliberations and work of the State Forest Commission and the Forest Preserve Board; also, a few scattered areas were agreed upon for survey to meet the urgent demands of special localities. Finally it was necessary to plan still further in advance for the extension of primary triangulation for the control of surveys over such areas as might require mapping during the next season.

In accordance with these general requirements it was agreed that three field parties should be placed in central New York to close the gap existing along the line of the Erie canal in the general neighborhood of Palmyra, Newark, Lyons and Weedsport; also for the mapping of the region south of the above named, including as much as possible of the watershed of Cayuga and Seneca lakes. This area is divided among the counties of Wayne, Ontario, Seneca, Schuyler and Chemung.

In southeastern New York, in order to fill the gaps existing along the route of the Hudson river and between this State and the State of Connecticut, it was planned that one party should survey a portion of the unmapped region east of Poughkeepsie and Rhinebeck, in Dutchess county, and also to the westward of Newburgh and West Point, in Orange county. It is interesting to note that the resulting maps have already been put at the service of, and have greatly facilitated the investigations of the New York city officials into the Ramapo water supply.

It was planned that another party should map portions of the Erie canal feeders south of Oneida, in Madison county. Still another was to be assigned to the continuation of the mapping of the country to the north of Saratoga included in the upper reaches of the Hudson and Sacondaga rivers, in Fulton and Saratoga counties.

Finally, two large parties were to be assigned to field work in the Adirondacks in the region about Raquette and Blue Mountain lakes.

To what extent these plans have been completed is clearly shown in the following report of operations in the field season of 1899, which is divided under three separate heads—triangulation, precise leveling, and topographic surveying. It should be stated, however, that all of the work outlined was not completed during the last field season for the reason that it was not considered economical to continue field work until too late in the fall. The plans therefore included the preparatiôn of certain areas for survey during the early spring of 1900 as was done in the past season. Accordingly, only so much final topographic surveying was undertaken as could be safely mapped during the winter, and it was thus possible to place the work in condition for its most speedy resumption in the early spring.

RESULTS.

Precise leveling.—Early in April Mr. E. L. McNair, levelman, assisted by Messrs. J. E. Buford and J. G. Mislin, rodmen, commenced the extension of precise levels northward from a bench mark of the United States engineers in Schenectady. They were engaged on this work during seventeen days, in which time they ran 81 miles of levels over the route of the D. & H. Railway via Saratoga and Hadley to Northcreek. At the latter point connection was made with the levels run during preceding years and published in the annual reports of this office since 1896. The result is a change in the elevations heretofore accepted for bench marks established throughout the Adirondacks of between .3 and .4 foot. In the course of this work there were established 12 permanent bench marks and 60 other bench marks of less permanence.

In conjunction with the precise levels run during the season of 1898, and heretofore published, there now exist three great belts of precise levels—one run by the United States Coast and Geodetic Survey up the line of the Hudson river and Lake Champlain from New York to the Canadian border; one extended by the United States engineers from the Coast Survey datum in Albany via the New York Central Railroad to Lake Ontario in the neighborhood of Rochester; the third extended last year by this survey from Albany, via Binghamton and Dunkirk. A fourth line, commenced during the past season and run northward as far as Northcreek, is planned for extension to the St. Lawrence river, an ultimate connection with the precise levels of the United States Coast Survey and the Canadian Survey near Rouses Point. This will furnish a complete network of precise levels for the adjustment of all the private and public levels of less accuracy which have been or may hereafter be run within the borders of our State.

The quality of the leveling run during the past season is quite up to the standard. The total expenditure on the precise leveling of the past season was in round numbers $450, including salaries and all contingent expenses. This was at the rate of about $5.62 per linear mile run, a sum well within the limits of expenditure heretofore incurred in similar work by this organization, and far below the amount expended by other organizations doing work of like precision.

Triangulation.—The field work of primary triangulation was not resumed until the first of July, when Mr. William T. Griswold was temporarily assigned the duty of extending primary triangulation in Saratoga and Warren counties for the immediate control of topographic mapping then in progress. During August he was withdrawn from the State of New York by the Federal officers in charge for field work elsewhere. He resumed field work in this State, however, early in September and continued it during the months of October and November. This later work was prosecuted in the central portion of the State and resulted in furnishing control for the topographic mapping of seven additional atlas sheets, including portions of the counties of Ontaria, Livingston, Yates and Steuben. Moreover, reconnoissance for triangulation and the erection of signals was extended over three atlas sheets covering portions of Tioga and Broome counties.

During the month of August, in conjunction with the extension of primary triangulation within the State of Pennsylvania, Mr. Oscar Jones, topographer, completed the control of two additional atlas sheets within the State of New York, in Steuben county, in the general neighborhood of Addison and Corning.

The triangulation executed by Mr. Jones was based on the old State survey points, Swale, Harrison and Bly. That extended by Mr. Griswold, in Saratoga county, was based on the point Crane previously established by this survey, and the Coast Survey point Prospect. That executed by Mr. Griswold in central New York was based on the United States lake survey points Scotsburg and Turks Hill on the north and the State survey points Swale and Urbana on the south. In all there were established in the State during the season 20 primary triangulation stations, each of which is well marked by a substantial stone monument capped by a bronze tablet suitably lettered. In addition, the work of the season resulted in the procurement of primary control for an area of about 1,920 square miles, which is now available for topographic mapping in addition to such areas as have been previously reported upon. The total expenditures in connection with this work was $2,030, or at the rate of a little over $1 per square mile controlled.

Topographic surveying.—The field work of the topographic surveys was resumed during the past season early in the month of

April, in accordance with the plans previously recited. The field work of the individual topographers was not, however, continuous during the season throughout the same localities, as it was found that their services could be more economically utilized by moving them in accordance with the seasons of the year. Thus, those parties which worked in the Adirondacks were employed during the months of April and May in the central portion of the State. Field work was prosecuted in the Adirondacks only during the most favorable months—those from June to September inclusive. The same parties were then assigned field work for the months of October and November in the more hospitable portions of the State. The following is a general outline of the work executed under the direction of the individual party chiefs.

Mr. J. H. Jennings, topographer, was assigned the general supervision of work within the central portion of the State. In conjunction with him, Messrs. J. H. Wheat, J. W. Thom, James McCormick and N. G. Van Doren, topographers, with several draftsmen, levelmen and other assistants, each had charge of semi-independent parties. Field work was commenced about April 15th and was prosecuted almost continuously until the end of October. During a portion of this time, however, one or more of these parties was withdrawn by the Federal officers from the State for field work within the borders of the State of Pennsylvania.

These parties completed the field work of mapping the Palmyra, Clyde, Weedsport, Phelps, Geneva, Ovid, Genoa, Waverly and Sodus Bay atlas sheets. In addition, they completed all the spirit leveling and traversing, as well as the plane table triangulation, for the control of Penn Yan, Canandaigua and

Hammondsport sheets. These latter are in such condition that their topographic mapping can be completed within a short time after the resumption of field work in the spring and with money already provided for this purpose.

Mr. W. H. Lovell, topographer, was in charge of the field work in Saratoga and Warren counties. With the aid of several assistants he completed the mapping of Saratoga and Broadalbin atlas sheets. In addition, he completed the secondary control for the mapping of Luzerne sheet during the next field season.

Mr. C. C. Bassett, topographer, was in charge of the topographic party working on the Hudson river. He completed the mapping of Millbrook and Turners sheets, and, with the aid of Mr. Walker, the secondary control for the mapping of Berne sheet, that immediately west of Albany.

Mr. A. M. Walker, topographer, assisted by Messrs. A. H. Bumstead and N. G. Van Doren, assistant topographers, had general charge of the topographic surveys in the Adirondacks, in conjunction with spring and fall work in other portions of the State. These parties, with their assistants, completed the topographic mapping of all of Raquette lake and half of Blue Mountain sheets in the Adirondacks; also of Morrisville sheet in Madison county. Moreover, they completed the secondary control for Richfield Springs sheet in Otsego and Herkimer counties.

The net results of the field work of the various topographic parties above enumerated is summed up in the following tabular form:

COUNTIES.	Sheet.	Topographers.	Number of days worked	Area mapped square miles.	Triangulation locations, No.	SPIRIT LEVELING.			TRAVERSE.	COST FIELD WORK ONLY.	
						Bench marks, No.	Miles, No.	Elevations, No.	Miles, No.	Total.	Per sq. mile.
Wayne, Ontario Wayne, Seneca Wayne Wayne, Cayuga	Palmyra Clyde Sodus Bay Weedsport	Clark Wheat Jenbings Thom	195	723	325	15	160	1,190	1,939	$3,970	$5 49
Ontario, Seneca Ontario, Yates Yates, Seneca Seneca, Cayuga, Tompkins	Geneva Phelps Ovid Genoa	Jennings Wheat Van Doren Thom McCormick	150	878	470	24	765	1,885	3,195	4,865	5 54
Dutchess Orange, Rockland	Millbrook Turners	Bassett	178	447	1,645	20	164	1,248	1,947	5,971	13 35
Hamilton	Raquette Lake	Walker Bumstead Van Doren	104	215	197	15	67	335	690	3,456	16 35
Madison, Oneida	Morrisville	Walker Van Doren	115	218	325	12	107	570	640	1,510	6 92
Saratoga Fulton, Saratoga, Hamilton	Saratoga Broadalbin	Lovell	90	436	700	15	204	1,000	1,400	3,300	7 57
Chemung, Tioga	Waverly	Cummin Van Doren	70	222	315	8	127	470	659	1,387	6 25
			902	3,139	3,977	109	1,594	6,688	10,452	$24,459	......
Partly Surveyed.											
Yates Ontario, Monroe Steuben, Schuyler, Wayne	Penn Yan Canandaigua Hammondsport	Wheat Jennings	40	......	360	24	395	825	805	1,720	
Otsego, Herkimer, Montgomery Albany, Schoharie, Schenectady	Richfield Springs Berne	Walker	55	24	204	8	123	384	572	2,358	
Saratoga, Tompkins	Luzerne	Lovell	16	40	160	7	100	382	605	1,090	
Hamilton, Essex	Blue Mountain	Walker	54	105	242	4	66	205	380	2,121	
			1,067	3,308	4,943	152	2,278	8,484	12,814	$31,748	

An inspection of the above table shows that topographic field work was in active progress during the season of 1899 in various portions of 27 different counties. There were completely mapped during the season 15 atlas sheets, while the secondary control, which is equivalent to about two-thirds of the map work, was completed upon 7 other atlas sheets. All told, the topographic survey was completed of 3,308 square miles, at a total cost for field work alone of $31,748. In addition to this, and included in the above expenditure, the partial survey of 1,370 square miles was completed. The average cost of field work for the mapping of the above area ranged between $5.54 per square mile in the most accessible portions of central New York and $16.35 per square mile in the roughest portions of the Adirondacks.

The balance of the appropriation of the co-operating surveys will be expended during the current office season in the inking and drafting of the maps and the computation of the primary triangulation. A large proportion of it will be expended in the early spring in completing the field surveys of the seven unfinish atlas sheets.

SPIRIT LEVELING.

Six parties were engaged under the immediate direction of the various topographers in running spirit levels through the areas under survey. This was with a view to the determination of elevations and the establishing of bench marks upon which to base the contour sketching of the area mapped.

These levels were run with the same care as heretofore described in preceding annual reports. The elevations are all reduced to mean sea level at Sandy Hook through the system of precise levels already referred to. In the prosecution of this work there were run 2,278 linear miles of levels, in the course of which there were established 152 permanent bench marks of bronze or aluminum, while about 2,000 other bench marks of less permanence were established. There were also determined the elevations of 8,484 other points for the control of the contour sketching. The localities in which this leveling was done, as well as the lengths of the closed and adjusted level circuits, with their closure errors, are submitted in the following tabular form:

LOCALITY.	Length of Circuit, miles	Closure, feet.	Levelman.
Morrisville	14	.310	Gilbert, W. W.
Saratoga	30	.091	Thomas, J. E.
Saratoga	37	1.052	Thomas, J. E.
Saratoga	7	.056	Thomas, J. E.
Saratoga	18	.786	Thomas, J. E
Saratoga	17	.024	Thomas, J. E.
Saratoga	25	.084	Thomas, J. E.
Saratoga	13	.189	Thomas, J. E.
Otsego	22	.277	Gill, A. W.
Otsego	40	.129	Gilbert, W. W.
North Creek	77	.436	McNair, E. L.
Weedsport	49	.33	Semper, C. H.
Raquette Lake	40	.07	Gilbert, W. W.
Raquette Lake	63	.132	Gilbert, W. W.
Raquette Lake	140	1.557	Gilbert, W. W.
Millbrook	58	.313	Van Loan, Seth M.
Genoa	15	.021	Green, W. E.
Genoa	45	.3	Green, W. E.
Newburg	37	.110	Van Loan, Seth M.
Tupper Lake	174	.062	Bailey, C. B.
Hammondsport	40	.175	Hammond, W. F.

SECONDARY LOCATIONS.

In the progress of the topographic mapping horizontal control was established by plane table triangulation and road traverse. As enumerated in a preceding table, the positions of 4,943 points were accurately determined by trigonometric methods, the elevations of which were ascertained at the same time and in the same manner. In addition 12,814 linear miles of road traverses were run and from these there were located by intersection about 1,000 additional positions. As a total result, the horizontal control of the maps consisted of approximately 2 trigonometric locations per square inch of map and of 3.3 linear inches of platted road traverse per square inch of map.

LAND CLASSIFICATION MAPS.

Heretofore, in connection with this topographic field work, it has been the practice to indicate upon the manuscript maps the outlines of the wooded areas. These have been of material assistance to the deliberations of the State Forest Commission, the work of the Forest Preserve Board and of other public and private institutions interested in the woodlands of the State. During the past season a new departure was made in this work and it was decided to extend the usefulness of the maps by roughly classifying the lands within the borders of the State according to the uses to which they were put at the time of the survey. It was determined to divide the lands of the State into the following four general classes, namely, (1) woodland, (2) pasture, or grass land, (3) cultivable land, (4) waste land. Woodland was to be classified as (a) merchantable timber and (b) tracts covered with trees or brush of such size or quality as to be available only for fire wood, fence posts, etc. Under the title of pasture land was classified not such lands as are cultivable or as might be used alternately as meadows or hay land, but only such lands as were partly covered with brush and stumps so as to render their classification indeterminate, they being occasionally used for pasturage or being allowed to run to brush. There was to be designated as waste land only such sandy areas or steep rocky slopes as were unavailable for cultivation or the growth of timber.

The classification of woodland and cultivable land was further subdivided by the insertion of a statement of the character and principal species of the trees, as well as by a statement of the predominant character of the crops grown.

As a result of this land classification survey there has been prepared in manuscript complete maps of the areas or atlas sheets surveyed, upon which is indicated by colors and numbers the various facts above enumerated. While no general plan has yet been determined upon for the publication of this material, it is available at all times for inspection in the office of the director of the United States Geological Survey, and copies of it may be procured by those desiring them for the trifling sum required in the making of the necessary tracings.

A result of the experience of the first season of this work has been the discovery of the astonishing fact that it has added imperceptibly to the cost of making the regular topographic survey. The topographers and their assistants indicate the outlines of the various areas in accordance with the classification at the same time that they make the topographic survey and the output of the latter does not appear to have been decreased or its cost increased. It is anticipated that the results of this work will prove of the greatest benefit to the State. An inspection of this map renders it at once possible for a prospective purchaser of lands, sitting in his office in a city, to ascertain not only the relative location of the lands, their accessibility and the ruggedness of their surface as shown by the topographic map, but also the availability of the lands for the purposes of agriculture, forestry or whether they are waste and valueless.

OFFICE WORK.

During the office season of 1898-9 all of the atlas sheets mapped during the preceding season were completely drawn up in office and were turned over to the engravers with a view to their publication. The engraving of a few of these has been completed and they have been printed and issued to the public. The remainder are still in the hands of the engravers and include the following seventeen sheets, representing an area of 3,728 square miles:

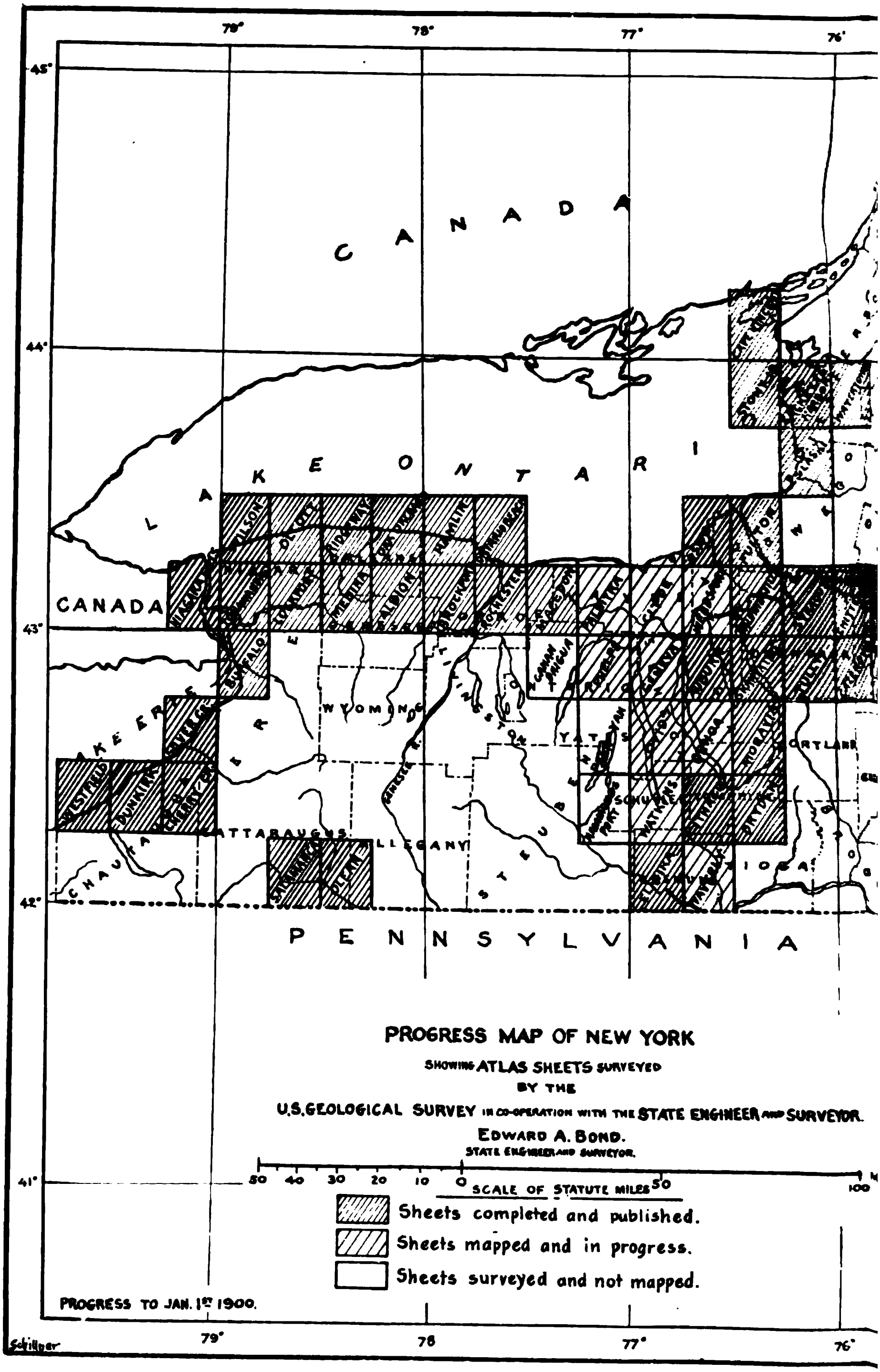
SHEET NAME.	Counties.	Area Square Miles.
Westfield	Chautauqua	221
Old Forg	Herkimer, Hamilton.	217
Dunkirk	Chautauqua	221
Silver Creek	Erie, Chautauqua, Cattaraugus	220
Cherry Creek	Chautauqua, Cattaraugus	221
Macedon	Monroe, Wayne, Ontario	219
Fulton	Oswego, Cayuga	218
Baldwinville	Onondaga, Cayuga, Oswego	219
Oswego	Oswego, Onondaga, Wayne	218
Watkins	Schuyler, Chemung	221
Dryden	Tomkins, Tioga, Broome	221
Canada Lakes	Hamilton	217
Wilmurt	Hamilton, Herkimer	218
Schuylerville	Saratoga	219
Little Falls	Herkimer, Fulton	219
Canajoharie	Montgomery, Otsego, Schoharie	219
Schoharie	Schoharie	220
		3,728

PUBLISHED SHEETS.

An inspection of previous annual reports will show that there have been published by the office of the United States Geological Survey 78 atlas sheets, covering a total area of 12,906 square miles.

Since the publication of the last annual report there have been issued from the engraving division of the United States Geological Survey 10 additional atlas sheets, as enumerated in the following list, thus making the total number of sheets published 88, and the total published area 15,096 square miles, or nearly one-third of the State:

SHEET NAME.	Counties.	Area Square Miles.
Auburn	Cayuga	219
Brockport	Monroe, Genessee	219
Hamlin	Monroe	218
Moravia	Cortland, Tompkins, Cayuga	220
Skaneatelas	Cayuga, Cortland, Onondaga	219
Cazenovia	Montgomery, Otsego, Schoharie	219
Indian Lake	Hamilton	217
Remsen	Oneida, Herkimer	218
Salamanca	Cattaraugus	222
Tully	Cortland, Onondaga	219
		2,190



PROGRESS MAP OF NEW YORK

SHOWING ATLAS SHEETS SURVEYED

BY THE

U.S. GEOLOGICAL SURVEY IN CO-OPERATION WITH THE STATE ENGINEER AND SURVEYOR.

EDWARD A. BOND.

STATE ENGINEER AND SURVEYOR.

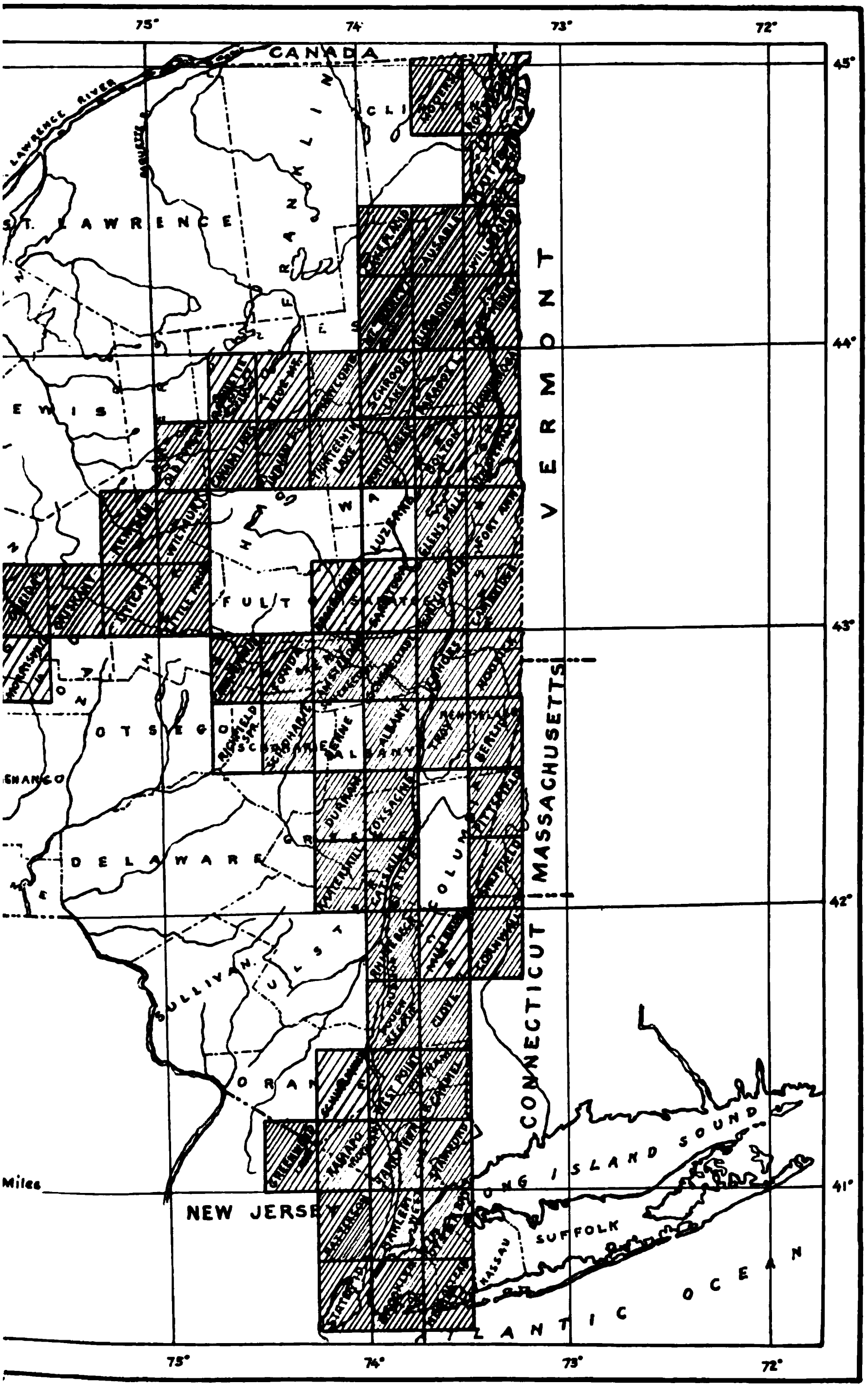
50 40 30 20 10 0 SCALE OF STATUTE MILES 50 100

▨ Sheets completed and published.

▨ Sheets mapped and in progress.

☐ Sheets surveyed and not mapped.

PROGRESS TO JAN. 1st 1900.


75°
74°
73°
72°
45°
44°
43°
42°
41°
CANADA
LAWRENCE RIVER
ST. LAWRENCE
FRANKLIN
CLINTON
ESSEX
LEWIS
HAMILTON
WARREN
FULTON
SARATOGA
OTSEGO
SCHOHARIE
ALBANY
GREENE
COLUMBIA
DELAWARE
ULSTER
SULLIVAN
ORANGE
CHENANGO
NEW JERSEY
VERMONT
MASSACHUSETTS
CONNECTICUT
LONG ISLAND SOUND
SUFFOLK
NASSAU
ATLANTIC OCEAN
Miles
LAKE PLACID
AUSABLE
SCHROON LAKE
THIRTEENTH LAKE
BOLTON
LUZERNE
GLENS FALLS
FORT ANN
SARATOGA
COHOES
TROY
BERLIN
ALBANY
BERNE
DURHAM
COXSACKIE
CATSKILL
KAATERSKILL
CORNWALL
CLOVE
WEST POINT
GREENWOOD
RAMAPO
STAMFORD
RICHFIELD SPR.
SCHOHARIE
AMSTERDAM
LITTLE FALLS
UTICA
REMSEN
WILMURT

The engraving, printing and issuance of these maps is done at the expense of, and by, the United States Geological Survey. Such a limited number of proofs as may be required by the office of the State Engineer are furnished for official use. Others desiring these maps can obtain them by addressing the Director of the United States Geological Survey at Washington, D. C., and enclosing five cents per copy, or at the rate of $2 per hundred. Upon the accompanying progress map is indicated such portions of the State as have been surveyed, including, however, all those which are not yet engraved and published.

CONCLUSIONS AND RECOMMENDATIONS.

It is evident from a perusal of the above that there have been surveyed and mapped to date, 121 separate altas sheets, depicting the topography of 21,964 square miles, or nearly 47 per cent. of the area of the State. There have been engraved and published 88 separate atlas sheets representing the topography of 15,096 square miles. Finally, the preliminary work incident to the future mapping, as primary triangulation, precise leveling and secondary control, has been extended well in advance so that the work is in excellent condition for future prosecution.

It seems idle to make here any further statement of the great value of this survey and the resulting maps to the State government, as well as to the counties and townships of the State and the railroads and other public corporations, and to the individual residents of the State. These facts I find have been fully set forth in reports of my predecessors. Yet I would scarcely feel that I had done my duty should I fail in this initial report to call your attention to my high appreciation of the results and value of the work or to record my hearty endorsement of its utility and the efficiency of its conduct.

It seems proper to recite, however, the fact that the average cost of making this survey to date has been approximately $11.30 per square mile, of which sum the State has expended considerably less than one-half, or $106,000 of a total outlay of $256,000. With this expenditure of $11.30 per square mile the outlay to the State ceases. On the other hand, the federal bureau has additional expenses to meet in engraving the maps, in printing them and in the prosecution of the geologic and hydrographic surveys which follow the publication of the topographic maps.

There remain unmapped about 25,490 square miles of the area of the State. That this work may be pushed to uninterrupted completion I urge upon you the appropriation by special act similar to chapter 96 of the general laws of 1899 of the sum of $30,000 for the continuation of this work during the ensuing year.

RESULTS OF PRIMARY TRIANGULATION.

In Appendix II of the last annual report of this office were published the descriptions of primary triangulation stations accupied during the field season of 1898. The positions of these stations have since been computed and are published herewith. Their descriptions are not repeated here, however, in the instances in which they were published in the prior annual. Such as were not described in that report are described herewith.

GENOA, CAYUGA COUNTY.

Latitude, 42° 41′ 06″.73. Longitude, 76° 33′ 13″.74.

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Murray	49 07 58.87	228 58 12.11	4.4175954
Newfield	16 02 07.83	195 57 26.00	4.5380981

MURRAY, SENECA COUNTY.

Latitude, 42° 31′ 51″.16. Longitude, 76° 47′ 40″.48.

TO, STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Niles	224 37 40.68	44 52 19.62	4.6227649
Newfield	327 18 33.27	147 23 ·36.95	4.2799573

SWEET HILL, SENECA COUNTY.

Latitude, 42° 49′ 37″.07. Longitude, 76° 50′ 41″.42.

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Geneva	99 55 11.20	279 48 12.57	4.1520561
Clyde	176 28 18.59	356 27 32.38	4.3976109

GENEVA, ONTARIO COUNTY.

Latitude, 42° 50′ 55″.85. Longitude, 77° 00′ 57″.12.

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Clyde	208 50 20.63	28 56 33.87	4.4099598
Ovid	319 52 23.23	140 .. 17.77	4.3925375

CHESHIRE, ONTARIO COUNTY.

Latitude, 42° 57′ 40″.47 Longitude, 77° 08′ 11″.67

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Turks Hill Eccentric	160 14 26.27	340 10 39.65	4.3478587
Orleans	241 01 03.25	61 59 29.34	4.2850665

SENECA FALLS, SENECA COUNTY.

Water standpipe. (Not occupied.)

Latitude, 42° 55′ 14″ 58 Longitude, 76° 47′ 38″.62

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Geneva	66 17 46.21	246 08 42.82	4.2966947
Sweet Hill	21 44 16 97	201 42 12.80	4.0496411

WATERLOO, SENECA COUNTY.

Water standpipe. (Not occupied.)

Latitude, 42′ 54′ 06″.38 Longitude, 76° 52′ 28″.99

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Geneva	63 02 07 30	242 56 21.57	4.1121019
Sweet Hill	343 36 52 42	163 38 05.58	3 9385948

ORLEANS, ONTARIO COUNTY.

Situated in town of Phelps, on highest part of north and south ridge, about 2 miles from Clifton Springs and 1 mile from Orleans; one-eighth mile east of road from Orleans to Clifton Springs.

Station mark: Stone post, 48 x 6 x 6 inches, set 42 inches in the ground, in center of top of which is cemented a copper bolt.

Station number: 491.

Latitude, 42° 55′ 44″.41 Longitude, 77° 07′ 25″.47.

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Palmyra	169 .. 21.86	348 58 51.62	4.1958451
Turks Hill	115 37 05.69	295 24 51.82	4.4317327

CLIFTON SPRINGS, ONTARIO COUNTY.

Cupola of Sanitarium. (Not occupied.)

Latitude, 42° 50′ 42″.37 Longitude, 77° 19′ 49″.13.

TO STATION.	Azimuth.	Back Azimuth.	Log. Distance.
	° ′ ″	° ′ ″	
Cheshire	50 52 18.10	230 44 23.30	4.3099819
Turks Hill	109 09 02.13	288 57 19.62	4.3924640

LIST OF ELEVATIONS FROM PRECISE AND SPIRIT LEVELING.

The elevations in the following list were determined in the course of running a line of precise levels from a United States engineer's bench-mark in Schenectady northward over the lines of the Schenectady and Saratoga branch and of the Adirondack branch of the Delaware and Hudson Railroad to a connection with the primary level bench-mark of the Co-operative Survey at North Creek. The elevations are dependent upon the precise levels brought from the grist mill bench-mark in Albany and are dependent upon the elevations published in the last annual report of this office for precise levels run between Dunkirk, Binghamton and Schenectady.

The leveling was done by Mr. E. L. McNair, assisted by Messrs. J. E. Buford and J. G. Mislin, rodmen, and was executed under the general direction of Mr. H. M. Wilson, geographer. All bench-marks placed in the progress of this work were marked with the word "Albany" and the date "1899," in addition to the figures of elevation.

SCHENECTADY, N. Y., VIA D. & H. RY. TO NORTH CREEK, N. Y.

	Elevation, feet.
Schenectady, N. Y. Central Ry. bridge over Erie canal, northeast corner of; coping stone of abutment marked "242 Albany 1899." Set in August, 1898	240.768
Ballston Lake, ¾ mile north of; coping stone at west end of stone culvert under railway. Aluminum tablet marked "269 Albany 1899"	268.689
Ballston, Saratoga county court-house; foundation stone 4 feet left of main entrance to. Aluminum tablet marked "320 Albany"	320.421

	Elevation, feet.
Saratoga, D. & H. Ry. station, 1,500 feet south of; coping stone at east end of north abutment of steel girder bridge No. 37 over Congress street. Aluminum tablet marked "314 Albany 1899"...	313.981
Greenfield station, 1-3 mile north of; coping stone at southeast corner of stone culvert under railway. Aluminum tablet marked "596 Albany 1899"..	595.916
Kings station, 0.8 mile north of; coping stone at northeast corner of stone culvert under railway. Aluminum tablet marked "602 Albany 1899"...	602.407
Hadley, 1½ miles south of; coping stone at northeast corner of stone culvert about 600 feet west of red house on west side of highway. Aluminum tablet marked "634 Albany 1899".............	633.882
Hadley, 3¼ miles north of; coping stone of bridge seat at northeast corner of steel girder bridge No. 9 over Wolf creek. Aluminum tablet marked "630 Albany 1899"...........................	630.031
Stony creek, 0.4 mile south of; coping stone of bridge seat at northwest corner of steel girder bridge No. 10 over Stony creek. Aluminum tablet marked "600 Albany 1899".................	600.000
Thurman, 1¼ miles north of; coping stone at west end of south abutment of steel girder bridge No. 13. Aluminum tablet marked "638 Albany 1899"..	627.837
The Glen, D. & H. station, 530 feet north of; coping stone of bridge seat at southwest corner of steel girder bridge No. 14; 5 feet west of girder. Aluminum tablet marked "749 Albany 1899"......	749.083

	Elevation, feet.
Riverside, 230 feet north of station door; 65 feet west of center of main track, in large flat rock outcrop 25 feet west of road. Aluminum tablet marked "883 Albany 1899"	883.216
Riverside, chisel mark, 2 feet northeast of tablet described above	883.156
North Creek station, 0.4 mile southeast of; bridge seat at southeast corner of steel girder bridge No. 18, 4.4 feet below east rail. Aluminum tablet marked "1001 Albany 1899"	1,001.064
North Creek station, 1,000 feet north of; in quarry outcrop on southwest side of track, 2 feet above track and about 6 feet from southwest rail. Bronze tablet marked "1012." Note: This tablet set in 1896; the published elevation of same in appendix to the twentieth annual report of director being 1,007.185	1,007.621
North Creek station, chisel mark on same rock as permanent B. M. described above and elevation published as 1,008.276	1,008.712

PRIMARY LEVELS.

In the following tabular form is published a statement which shows the localities in which primary levels were run during the past field season and which have been checked either by closure upon the starting points or upon some other known point, the elevation of which is accepted as final. In the second column of this table is a statement of the lengths of closed circuits of such levels in miles. In the third column is a statement of the closure error in decimals of a foot. It will be observed that there were run during the season fifteen closed circuits and they all checked out well within limits of precision which could be expected in work of this class.

Following this tabular statement is appended a list of elevations derived from the primary levels of the preceding season of 1898. These were not published in the last annual report of this office because they had not yet been reduced by adjustment to mean sea level. Those of the past season are not published herewith for the same reason, but will be published in the next annual report of this office. In addition to the elevations listed herewith, many other intermediate points had their heights determined, but only those are printed which correspond to bench-marks permanently indicated on the ground by bronze or aluminum tablets.

LOCALITY.	Length of Circuit, miles.	Closure, feet.	Levelman.
Hammondsport	68	.148	W. T. Hammond.
Geneva	61	.143	C H. Semper.
Macedon	50	.110	C. H. Semper.
Newark	55	.264	C. H Semper.
Geneva	26	.080	C. H Semper.
Long Lake	60	.469	W. W. Gilbert and A. W. Gill.
Raquette Lake	45	.358	W. W. Gilbert.
Ne-ha-sa-ne, Tupper Lake and Long Lake	151	.103	W W. Gilbert.
Luzerne	15	.201	J. E. Thomas.
Nashville and Saratoga	60	.217	J. E. Thomas.
Richfield Springs	36	.095	A. W. Gill.
Millbrook	57	.313	Seth Van Loan.
Turner	37	.110	Seth Van Loan.
Morrisville	47	.223	W. W. Gilbert and A. W. Gill.
Morrisville	34	.164	W. W. Gilbert and A. W. Gill.

CHAUTAUQUA COUNTY.

Westfield, Dunkirk, Cherry creek, and Silver creek Quadrangles.

The elevations published in the following list were determined during the field season of 1898, are based on the United States Engineer Corps bench-mark, top of water table of Nelson block, in Dunkirk, N. Y., the elevation of which is accepted as 588.235 feet.

All bench-marks dependent on this datum are marked with the letter " D " in addition to the figures of elevation, thus referring them to Dunkirk as a datum.

	Elevation, feet.
Laona; in top stone north abutment, west side of iron-deck bridge over Canadaway creek, Dunkirk, Allegheny valley and Pittsburgh Railroad; copper plate marked " 817 D "........................	817.295
Stockton; 500 feet west of Chrisses' hotel, 4 feet above ground east side of blacksmith shop on Mayville street; copper plate cemented in stone foundation of shop, marked " 1,316 D "................	1,316.890
Mayville; in top stone east abutment north end east highway bridge over Black brook; east side of town and west side of cemetery; copper plate marked " 1,324 D ".............................	1,324.234
Prospect, foundation of Western New York and Pennsylvania Railway station office at; copper plate in northeast corner marked " 1,213 D "....	1,213.552
Brockton, 1 mile north of; copper bolt in south side of center pier of double arch (stone) of Lake Shore Railroad over Slippery Rock creek; ¼ mile east of station, marked " 667 D "......................	667.887
Charlotte Center; copper bolt in stone in place 12 feet north of road; 6 inches above surface of ground; opposite farm in line 640 feet east of road turning off south, marked " 1,915 D "...........	1,915.256

	Elevation, feet.
Arkwright Center, 0.9 miles east of; copper bolt in large stone in place on north side of road; 15 feet north of center of road; 2 feet above ground; opposite frame house on north side of road, marked "1, 570 D"	1,570.375

CATTARAUGUS AND ALLEGANY COUNTIES.

Salamanca and Olean Quadrangles.

The elevations published in the following list were determined in the field season of 1897, and are based on a bronze tablet set in brick schoolhouse No. 4, Maple street, Salamanca, and marked "D 1,390." All bench-marks left in the course of this work are marked with the letter "S" in addition to figures of elevation, and are thus distinguishable from those left in connection with the Olean leveling of 1896, which were marked with no datum letter, and from the precise-level line run in 1898, the bench-marks of which are marked with the datum letter "D."

	Elevation, feet.
South Vandalia station, 3 miles south of; copper bolt in bowlder 2 feet outside fence on west side road 55 feet south of road east and 140 feet north of M. Kelly's white house on west side of road; bolt is marked "1,529 Ft. S"	1,523.294
Allegheny river iron highway bridge, 0.83 miles south of, and 4 miles north of Limestone; copper bolt in large bowlder nearly buried in ground on west side of road between it and ditch, pole bars entering pasture fields on each side of road; bolt marked "1,410 Ft. S"	1,404 868

	Elevation, feet.
Salamanca, Maple street; brick schoolhouse No. 4; bronze tablet, in water table at west side of front entrance, marked "1,396 Ft. S"................	1,390.630
Killbuck, 3.9 miles north of; copper bolt in stone abutment at southwest corner of iron bridge across Wright's creek, about ¼ mile above its juncture with Great Valley creek, bolt is marked "1,456 Ft. S"......................................	1,451.078
Humphrey, W. J., Sherman's hotel; copper bolt in stone doorstep in front of porch, west side, marked "1,626 Ft. S"................................	1,620.599

YATES, SCHUYLER, STEUBEN AND CHEMUNG COUNTIES.

Watkins Quadrangle.

The elevations published in the following list were determined during the field season of 1898, are based on a bronze tablet set in the Schuyler county court-house, in Watkins, New York, and marked "D 476." The elevation of this bench-mark above mean sea level is derived from the nearest bench-mark of the line of precise levels run by this survey through Horseheads. Based on this the height of the Watkins bench-mark is accepted as 476.631 feet above mean sea level.

All bench-marks dependent on the Watkins datum are marked with the letter "D," thus referring them to the bench-mark at Dunkirk, through the precise-level line.

	Elevation, feet.
Millport; bronze tablet in face of abutment at southwest corner of highway bridge over Catherine creek at Millport house; marked "709 D"......	709.855

	Elevation, feet.
Watkins, Schuyler county court-house; bronze tablet set in foundation at front; northwest corner, second course of stone from top, 3 feet south of corner; marked "476 D"	476.631
Burdette station, 600 feet south of; copper bolt set in north end of coping west end of culvert under Lehigh Valley Railroad; marked "100 D"	1,002.655
Odessa, 550 feet south of station; bronze plate set in in face of coping near north end on west end of culvert under Lehigh Valley Railroad; marked "1,053 D"	1,053.851
Beaver Dams, house of David Beardsley; aluminum plate set in foundation of house, center of front, second course from top; marked "1,262 D"	1,262.407
Reading Center, Baptist Church at; bronze plate set in foundation, south side; fourth course from top, 4½ feet from southeast corner of church; marked "1253 D"	1,253.155
Burdette station, 4 miles north of; copper bolt set in west end of south abutment of Lehigh Valley Railroad bridge over small stream, 100 feet north of milepost 314, back of house of B. J. Erway on Lake road; marked "939 D"	939.699

TOMPKINS, CORTLAND, SCHUYLER, TIOGA AND CHEMUNG COUNTIES.

Waverly and Dryden Quadrangles.

The elevations published in the following list are based on the aluminum tablet set in the city hall building at Waverly, marked "840 Albany 1898." The elevation of this bench-mark above mean sea level is dependent upon the Gristmill bench-mark at Albany, from which it is derived through the line of precise levels run by this survey through Waverly. Based on this, the height of the Waverly bench-mark is accepted as 838.582 feet above mean sea level.

All bench-marks dependent on the Waverly datum are marked with the letter " A," referring them to the Gristmill bench-mark at Albany.

	Elevation, feet.
Breesport, county buildings; on west face of foundation of brick structure, 3 feet above ground and 25 feet south of the northwest corner, between second and third cellar windows therefrom; aluminum tablet, marked " A 1160 ".....	1,159.667
Swartwood, residence of Benjamin Barnes; center of foundation north wing, front of house; permanent bench-mark, aluminum tablet, marked " A 1054 "	1,053.559
Spencer, southwest corner of Main and Tioga streets; in water table on north side of Fisher Block, 1 foot east of northwest corner; bronze tablet, marked " A 995 ".........................	994.461
Wilseyville, 2¼ miles north of; Delaware, Lackawanna and Western railroad bridge over highway; south abutment under west rail and 2½ feet above ground; aluminum tablet marked " 957 "........	957.214
Slaterville Springs; town clerk's office; east side of building; near northeast corner, 3 feet above ground; permanent bench-mark; aluminum tablet, marked " A 1120 "........................	1,120.319

	Elevation, feet.
Speedsville, O. F. Freeland's store; west side of building, 8 feet north of southwest corner, in top course of masonry foundation; aluminum tablet, marked "A 1121"	1,120.900
Dryden, Southworth Library Building; aluminum tablet set in foundation course of masonry south front of structure, marked "A 1090"	1,098.466
Ithaca, Cornell University, civil engineering building; bottom course of foundation, south end of building; 5 feet east of the southwest corner; aluminum tablet marked "A 814"	814.025

MONTGOMERY AND SCHOHARIE COUNTIES.

Canajoharie and Schoharie Quadrangles.

The elevations published in the following list are based on a bronze tablet set in a foundation stone in the northwest corner of the Union school building in Cobleskill and marked "930 Albany 1898." The elevation of this bench-mark above mean sea level is derived from the line of precise levels run by Mr. E. L. McNair, of this survey during the current field season, and based on the Gristmill bench-mark at Albany.

The elevation accepted for this Cobleskill bench-mark is 929.101 feet above mean sea level.

All bench marks dependent upon this datum are marked with the letter "A," thus referring them to Albany as a datum.

	Elevation, feet.
Canajoharie, Union Free School; west front, south of stone steps, in stone balustrade; aluminum tablet marked "A 350"	349.843
Blaine; coping of cemetery wall, 50 feet from east end; aluminum tablet marked "A 943"	942.857

	Elevation, feet.
Sharon, opposite Lutheran church and schoolhouse; outcropping ledge in field southwest of road; aluminum tablet, marked "A 1212"	1,211.364
Sharon Springs, 700 feet north of main east and west road, through Rockville, 500 feet from top of hill, in outcrop in west side of street; aluminum tablet, marked "A 1295"	1,294.549
Hessville; ½ mile south of schoolhouse, 150 feet north of road to west, opposite house and 15 feet east of road, in bowlder 8 feet broad; aluminum tablet, marked "A 826"	825.529
Fort Plain, Erie Canal Lock No. 32; towpath coping, end of anchor, northeast gate; chiseled cross within chiseled circle (Canal B.M. No. 171)	311.576
Fort Plain, Union Free School; Division street front, water table 1 foot from south corner; aluminum tablet, marked "A 316"	316.515
Hallsville, south end of cheese factory, stone foundation 1 foot from east corner; aluminum tablet, marked "A 509"	508.667
Barnerville, 200 feet west of covered bridge, 100 feet north of Main street, at iron bridge over Mill race; south abutment, east wing; aluminum tablet, marked "A 827"	826.756
Schoharie; court house; south side of south door, in west front; beveled jamb; aluminum tablet, marked "A 611"	610.577
Middleburg, schoolhouse, east front, south of entrance, in foundation wall; aluminum tablet, marked "A 649"	649.051

	Elevation, feet.
West Fulton, iron bridge across Panther creek; south abutment, east end, in coping; aluminum tablet, marked "A 1156"	1,156.650
Breakabeen, Lutheran church; foundation west side 5 feet from front corner; aluminum tablet, marked "A 754"	753.823
Franklinton, at schoolhouse, southwest corner of foundation; aluminum tablet, marked "A 1215".	1,214.407

MONROE, ONTARIO, WAYNE, SENECA, CAYUGA, ONONDAGA AND OSWEGO COUNTIES.

Macedon, Newark, Lyons, Weedsport, Oswego, Fulton and Baldwinsville Quadrangles.

The elevations published in the following list are based on the aluminum tablet set in the post office building in Oswego and marked "295 Oswgo." The elevation of this bench-mark is accepted as 294.738 feet above mean sea level.

All bench-marks dependent on this datum are marked with the letters "Oswgo," in addition to the figures of elevation.

	Elevation, feet.
Sodus; aluminum tablet in water table at southwest corner of Third M. E. Church on Ridge street; marked "457 O"	457.245
Red Creek; aluminum tablet in stone foundation of Red Creek Academy, situated on Second street, 225 feet north of Rome, Watertown and Ogdensburg railroad, on west side of street, marked "355 Oswgo"	355.400
Hannibal, schoolhouse on Oswego street at; aluminum tablet in stone doorsill of north entrance; marked "354 Oswgo"	354.043

	Elevation, feet.
Oswego; post office building, corner of Oneida and West First streets; water table northeast corner; aluminum tablet, marked "295 Oswgo"........	294.738
Webster; Union Academy, in water table at northeast corner of building; aluminum tablet, marked "465 Oswgo"	465.215
Fairport; Union School; in water table of Church street front; aluminum tablet, marked "498 Oswgo"	498.054
Walworth; Walworth Academy; water table at northwest corner of building; aluminum tablet, marked "564 Oswgo".........................	563.895
Palmyra; 1 mile west of; Mud Creek Aqueduct; in buttress, south wing, west abutment; aluminum tablet, marked "446 Oswego"..................	
Williamson; Union Academy; northwest corner of building; aluminum tablet marked "454 Oswgo".	453.833
Marion; 500 feet north of the Four Corners; Main street front of the Marion Collegiate Institute; aluminum tablet, marked "462 Oswgo"........	461.803
Fairville; brick schoolhouse, district No. —, 475 feet west of the Northern Central railway; in masonry foundation, 7 feet south of front entrance; aluminum tablet, marked "456 Oswgo".	455.802
Newark; southwest corner of Charles and Miller streets; in water table of Miller street front, Baptist Church, 1 foot from northeast corner; aluminum tablet, marked "457 Oswgo".........	456.595

	Elevation, feet.
Minetto; State dam, west side of Oswego river; southeast corner of third bulkhead pier on top of surface; aluminum tablet, marked "302 A"	302.314
Fulton; aluminum tablet in town hall, northwest corner in water table; South First street; marked "363 A"	363.446
Phoenix; Bridge and Cherry streets; northwest corner of Union Academy, Cherry street front; water table; aluminum tablet marked "394 Oswgo"	394.066
Phoenix; canal bench mark, Oswego Canal; copper bolt in second step of abutment, south end, on Bridge street; marked "364 A"	364.054
Phoenix; canal bench mark, Oswego Canal; Guard Lock No. 1; copper bolt in upper hollow quoin between cinchers; marked "363 A"	363.458
Baldwinsville; southeast corner of Free Academy on Elizabeth street; aluminum tablet, marked "423 Oswgo"	423.438
Baldwinsville, 0.5 mile south of; on cement stepping stone in front of James Kelly's house, on Syracuse street, southeast corner stone	384.608
Warner's, 700 feet east of crossroads; Mr. Hawley's brick dwelling; in east end of stone water table; aluminum tablet marked "477 Oswgo"	477.423
Gilbert's Mills, southeast corner of district school No. 5, aluminum tablet, marked "435 Oswgo"	435.054
Vermillion; aluminum tablet on southeast corner of Methodist Church on Main street, marked "422 Oswgo"	421.509

	Elevation, feet.
South Scriba; aluminum tablet in southeast corner of Ladies' Aid Society Hall on north side of Hall road, marked "400 Oswgo"	400.487
Bowen's Corners; stone doorstep, south door of brick schoolhouse, district No. 5; aluminum tablet marked "449 Oswgo"	448.593
Plainville; aluminum tablet in top step of schoolhouse, district No. 5; 300 feet west of four corners at center of town on north side of road, marked "403 Oswgo"	402.679
Ira Station; bronze tablet in northeast corner of water table of brick house situated about 700 feet southwest of station	430.329
Conquest, 0.6 miles south of; in front of brick house on south side in water table; house on east side of road; bronze tablet marked "449 A"	448.845

EXAMINATION OF BOUNDARY LINE MONUMENTS.

Chap. 421, Laws of 1887.

During the year of 1887 and every third year thereafter the State Engineer and Surveyor is authorized and directed to make an examination and inspection of the monuments marking the boundary lines of the State, and if any such monuments are found removed, displaced or missing, the State Engineer and Surveyor, in connection with the duly authorized representative of the adjoining State, is directed to replace and reset the same.

During the summer and fall of 1899 an examination of the monuments marking the line between the State of New York and the State of Vermont and of the monuments marking the land line between the State of New York and the State of New

Jersey from the Hudson river to the Delaware river, was made by Mr. Merritt Peckham, Jr., and his report as to the condition of these lines as marked and his suggestions for their betterment are shown in his report hereto appended. We are in correspondence with the proper officers in the State of Vermont with the view of ascertaining if they will co-operate with this State, in the work of relocating and remonumenting the line between the two States, and I urgently recommend that the State of New York join in this work.

The provisions of the law have been fully carried out in regard to the boundary line between New York and New Jersey and that line is now well established and clearly marked by monuments.

I am pleased to state that the boundary line between this State and the commonwealth of Massachusetts has been finally and completely established and monumented. The maps and plans showing the location of the line as established and the location of the monuments as set are shown in the report of Mr. Chas. H. Flanigan, who was in charge of this work and whose report is hereto appended.

An act will doubtless be passed by the Legislature of Massachusetts during the coming session, adopting and ratifying the line as established and monumented; and I recommend that the Legislature of this State should also pass a similar act at its coming session, adopting and ratifying the line on the part of the State of New York.

Boundary Line Between the Counties of Lewis and Herkimer in the State of New York.

Chapter 569, Laws of 1899 (Vol. 2, page 1192), approved May 12, 1899, reads as follows:

> "The sum of nine thousand five hundred dollars is hereby appropriated for the purpose of locating and establishing the county line between the counties of Lewis and Herkimer, and the state engineer is hereby authorized and directed to locate, survey, establish and mark the said boundary line."

Pursuant to this act the necessary surveys have been made and the line has been located, and permanently marked by seventy-nine monuments distributed at selected points along its total length of thirty-three and three-eighths miles.

The following statement shows the conditions as found; the decisions as reached; the survey as made and the monuments as placed:

By chapter 63 of the Laws of 1788, the Legislature created the county of Montgomery. (Page 150, Greenleaf Edition Laws of New York.)

By chapter 11 of the Laws of 1789 the Legislature set off the county of Ontario from the county of Montgomery. (Page 220, Greenleaf Edition Law of New York.)

By chapter 10, Laws of 1791, the county of Herkimer was set off from the county of Montgomery. (Page 342, ibid.)

And by chapter 31, Laws of 1798, the county of Oneida was set off from the county of Herkimer. (Page 295, Robins Ed., Laws of New York, 1798.)

By chapter 51, Laws of 1805, the county of Lewis was set off from the county of Oneida. (Pages 146-147, Barber's Ed., Laws of New York, 1805.)

The description of the county of Oneida describes the westerly line of Herkimer county and the easterly line of Oneida county, as follows:

> "* * * thence northerly to the west Canada Creek, thence northerly up the waters of said creek to the forks thereof, thence easterly up the east branch of said creek to the northeast corner of Service's Patent, thence north to the north bounds of the State. * * *"
>
> (Page 295, Robins Ed., Laws of New York, 1798.)

The description of the county of Lewis, as given in the act above referred to, reads:

> "From the southwest corner of the town of Turin, thence north 62° east along the southerly line of a tract of land known by the name of Macombs Purchase to the line of the county of Herkimer, thence north along the said last mentioned line to the bounds of the county of St. Lawrence." (Pages 146-147, Barber's Ed., Laws of New York 1805.)

These quotations show that the east line of the county of Lewis was intended to conform to and be identical with the west line of the county of Herkimer north of the point where the east line of the county of Herkimer was intersected by the southerly line of Macombs Purchase; and that the east line of the county of Lewis was a part of that boundary between the counties of Oneida and Herkimer, as established in 1798, and running north from the northeast corner of Service's Patent.

The descriptions given in the above quoted laws constituted the only records of these boundaries; no accurate surveys being made of the lines described.

By chapter 169 of the Laws of 1852, the Legislature directed the Commissioners of the Land Office to cause the boundary line between the counties of Herkimer and Lewis to be surveyed, permanently established and plainly marked. (Page 231, Laws of of New York, 1852.)

Nothing was done under this act.

By a joint resolution of the Senate and Assembly, in 1881, the Superintendent of the Adirondack Survey was directed to locate the Lewis and Herkimer county line. (Page 85, Report of the State Land Survey, 1886.) (Laws of 1881.)

Operations under this act were conducted during 1881 and 1883, and were limited to that portion of the line forming the boundary between the counties of Oneida and Herkimer. (Pages 81 to 111, ibid.)

PRESENT SURVEY.

By chapter 569, Laws of 1899, Vol. 2, page 1192, approved May 12, 1899, the State Engineer was authorized and directed to make this survey: Compliance with the law required,

First. The determination of the northeast corner of Service's Patent.

Second. The determination of the direction in which the compass needle pointed from this corner in 1798.

This last requirement was based upon section 3, title 1, chapter 2 of part 1, of the Revised Statutes 1889, Ninth edition, vol. 1, page 257, which reads as follows:

> "All lines which, in the foregoing bounds are described by courses indicated by the magnetic needle, are respectively to be taken as the magnetic needle pointed at the several times when such lines were originally established."

Regarding the location of the northeast corner of Service's Patent; there is in the office of the Secretary of State the original manuscript which reads as follows:

> "Pursuant to a warrant from His Excellency, Sir Henry Moore Baronett Captain General and Governor in Chief etc, etc., had surveyed for Peter Servis Moses Tibbet * * * and John Symons all that certain tract of land * * * in the County of Albany purchased by His Excellency from the Oneida Indians by deed bearing date the 1st day of October 1766 * * * south seventy-three degrees thirty minutes east to Canada Creek and thence down the stream as it runs * * * containing twenty-five thousand acres of land and the usual allowance for highways."

This manuscript gives for the first time the bearing of the north line of Service's Patent, at whose easterly end is the desired northeast corner.

In the office of the State Engineer and Surveyor, at page 81 of Land Papers, Book No. 1, there is on file an old field book which reads as follows:

> "Field Book belonging to John and Arch'd Campbell of a survey belonging to George Klock, Hendrick Remsen and Associates, Performed October 1787, Began at the west side of Cannada Creek Oposit to the 48 Lot in Jarsey Field Patent and run west 599 Chains to the East bounds of a Patent Granted to Baron Steuben thance along his Bounds & the West Bounds of Peter Servis' North 15° D. East 31 ch. to the N. W. Corner of said Servis' Patent Thance along an Old Line S. 74° 30 M. E. 470 Chains to Cannada Creek. Then returned to the said N. W. Corner of said Servis' Patent and measured along said Steuben's East Bounds * * * "

This gives the magnetic bearing of the north line of Service's Patent in 1787.

In the office of the State Engineer and Surveyor is a map filed as Roll No. 78, in Case No. 1 of the archives of the Land Office. This map is entitled as follows:

> "Map of Lands Laying North West of a Patent Called Jersey Field Beginning at the North East Corner of Lot No. 86 in S'd Jersey Field and Runs North 31° East 300 Chains to a Spruce Tree Corner'd * * * thance * * * to a Mapel Tree Corner'd for the N. W. Corner of a Patent Granted to Peter Servis' & Others. Thance South 74° 30 Minets East 470 Chains to Canada Creek, thence up said Cannada Creek Joyning to the West Bounds of said Jersey Field * * * to the place of Begining Containing 68,542 Acres.
>
> (Signed) Arch'd Campbell,
> Dep. Sury'r
> Located 3 July 1786.".

On this map are shown on a scale of 60 chains to the inch, the North line of the Service's Patent and its intersection by the west line of the Machin Tract and by the east line of the DeWitt Tract, both of which intersections are shown as being at the same point and defining the northeast corner of the Service's Patent as being on the bank of a sharp bend of Canada Creek.

This evidence that the northeast corner of Service's patent is the intersection of the north line of this patent by the west line of the Machin tract in confirmed by a document on file in the office of the Secretary of State at page 85 of Vol. 47, filed October 22d, 1789, and reading as follows:

> "I do hereby certify that Thomas Machin By virtue of An Act of the Legislature entitled 'An Act for raising Two Regiments for the defense of this State on bounties of unappropriated lands * * * is entitled to All that certain

Tract of Land Situate in the County of Montgomery on the North side of the Mohawk River Beginning at the North East corner of a Tract of Land granted to Peter Servis and others, on the Canada Creek and running thence North nineteen degrees West two hundred and thirty-five Chains, then North seventy-one degrees East two hundred and thirty-five Chains, thence South nineteen degrees East two hundred and thirty-five Chains to the Middle of the said Canada Creek and then down through the middle of the said Canada Creek to the place of Beginning containing five thousand four hundred Acres.

(Signed) SIMEON DEWITT,
Surveyor-General."

Thorough search was made of all the records on file in Albany with the above described results, and search was also made of the records in the office of the county clerk of Oneida county and of the clerk of the county of Herkimer.

Before beginning the actual work of the survey, the State Engineer arranged for a conference with members of the county line committees of the boards of supervisors of both counties. This conference was held in the city of Utica on June 12th, 1899, and there were present: State Engineer and Surveyor Edward A. Bond, Deputy State Engineer Wm. Pierson Judson, and Assistant Engineer C. H. Flanigan who was to make the survey, and also the members of Assembly and the representatives of the board of supervisors of both counties whose names are signed to the following agreement which was executed at this conference, and which here follows:

LEWIS AND HERKIMER COUNTY LINE.

General description of the method of procedure by which State Engineer and Surveyor E. A. Bond (acting under chapter 569 of the Laws of 1899) is to determine and locate the boundary line between the counties of Lewis and Herkimer in the State of New York, as presented at the formal conference between the members of the county line committees of the two counties and the State Engineer and Surveyor; said conference being held in the city of Utica on June 12th, 1899, and resulting in the unanimous approval of the said method of survey, and in the attached agreements to abide by the results.

Proposed method.

In determining the line between the counties of Lewis and Herkimer, it seems evident that it should be run now as it would have been run in 1798 if the makers of the original description had then had it located: It is the opinion of Elisha B. Powell, Esq., a prominent lawyer of Oswego county, who has had much practice in Adirondack land cases and who has been personally familiar by frequent visits to the woods during many years past with all the local conditions, that the "due north" of the description can only be taken to mean the direction, from the starting point, in which the compass-needle pointed at that place, at the date of the description, or 1798; and that the intent was simply to run a straight line, in that direction to the St. Lawrence county line, and not to introduce the refinement and the complication of running the slightly curved line which would be necessary in order to follow a line having a constant deviation from a meridian-line. A straight line can, at any time in the future, be followed and retraced by any surveyor. A line having a constant deviation from a meridian-line would seem, by such an ordinary re-survey, to be wrong, and no surveyor with ordinary instruments could follow or retrace it, because he could not make the complicated calculations needed to determine the curve, which would be slight.

Hence it seems best for all reasons, to simply determine, from the records at Albany and at Washington, what was the deviation of the compass needle in 1798 from the true meridian, or the line pointing to the North star, or Polaris, in 1798. Then, having found and determined the described starting point (at the northeast corner of Service's patent) to then accurately determine the true meridian at this point by repeated and accurate observations of Polaris; then, from this line, to turn off the angle which the magnetic needle of 1798 is found to have made with this line, and then to run on this course, a *straight line* which anyone can follow or reproduce at any time.

To facilitate such retracing, monuments should be placed all along the line at known distances, and record be kept of the present magnetic bearing at each monument. Thus avoiding all reason for further discussion or differences of opinion, as to the correct boundary.

June 12th, 1899.

(Signed) EDWARD A. BOND,
State Engineer and Surveyor.

BAGG'S HOTEL, *Utica, N. Y.:*

Agreement.

June 12th, 1899.

The undersigned members of the county line committees and representatives of the counties of Lewis and Herkimer, being appointed with power to act for those counties in the matter of the mutual county line, as evidenced by the proceedings of their several boards of supervisors, copies of which are to be attached hereto, having heard read by the State Engineer and Surveyor the accompanying statement of the method of procedure by which he proposes to determine and locate the said boundary line, do hereby for their respective counties, agree thereto and agree that the result of the survey which is to be made by the State Engineer, as here described in general terms, will be accepted as final by their said counties.

For Herkimer County:

(Signed) CHARLES L. FELLOWS,
(Signed) D. MOYNEHAN.

For Lewis County:

(Signed) CHAS. E. LAKE,
(Signed) H. N. GAYLORD.

BAGG'S HOTEL, *Utica, N. Y.:*

June 12th, 1899.

The undersigned members of the Assembly from the counties of Lewis and Herkimer, being present at the conference between the representatives of their counties (in the matter of the establishment of the county line) and the State Engineer and Surveyor, and having heard read the statement of the State Engineer and Surveyor as to the proposed method of such survey, hereby express their opinion that this is the proper method to get the desired result.

(Signed) ADDISON L. CLARK,
Lewis County.
(Signed) E. E. KELLEY,
Herkimer County.

EXTRACTS FROM PROCEEDINGS OF BOARD OF SUPERVISORS FOR HERKIMER COUNTY.

Adopted at a meeting of the board of supervisors December 13, 1895, and repeated at meeting of board December 11, 1896:

"*To the Honorable Board of Supervisors of Herkimer County:*

"Gentlemen.—Your special committee which was appointed to act with a like committee appointed by the honorable board of supervisors of Lewis county, to which committee was referred the matter of arriving at some feasible plan whereby the boundary line between the counties of

Lewis and Herkimer could be permanently established, most respectfully report:

"That we have met said committee from Lewis county, and that after careful consideration we recommend the adoption by our respective boards of the following resolution: Be it

"*Resolved*, That we, the members of the board of supervisors of the county of Herkimer most respectfully request the honorable, our State Senator and Member of Assembly to interview the Comptroller of the State of New York, and urgently request him to cause such surveys to be made which will locate, mark and permanently establish the boundary line between the counties of Lewis and Herkimer, and to use all honorable means to attain this object; and be it further

"*Resolved*, That they also present to the Comptroller a petition signed by the members of the board, and we recommend the following as such petition:

"The undersigned, constituting the board of supervisors of the county of Herkimer, respectfully present that it is important to the proper administration of the criminal law of the State, the granting of licenses and the assessment and levying of town, county and State taxes and the protection of private rights that the boundary lines between the counties of Lewis and Herkimer, which are now uncertain and in dispute, be correctly ascertained, determined and settled, to the end that crimes against the public laws may be speedily punished, private rights protected and the laws administered more speedily and with less expense, and they therefore petition that you cause such surveys to be made as shall correctly establish and mark such boundary lines as speedily as may be consistent with your duties.

"(Signed) J. A. HARVEY,
"(Signed) E. E. KELLEY,
"*Committee.*"

> Copy of resolution adopted at meeting of board of supervisors November 19, 1897:
>
> "*Resolved*, That the chairman of this board appoint a committee of three in regard to the boundary line between the counties of Hamilton and Herkimer and the counties of Lewis and Herkimer, and the said committee use all honorable means in their power to hasten the locating and establishment of the correct and proper boundary line, and that said committee be empowered to procure legal service to assist them in their efforts to have the correct boundary lines established, and in all matters to represent the board of supervisors in regard to the establishment of said boundary lines and report to this board on or before the next annual session."
>
> Special boundary line committee appointed at meeting of the board December 30, 1898: Messrs. Fellows, Moynehan and Wheeler."

Further search was then made of records in the office of the county clerks and of deeds and descriptions in the possession of the owners of property in the Service patent, Machin tract, DeWitt tract, Jerseyfield patent, etc.

After careful study of the material thus obtained, actual field work was begun on June 26th, 1899. The first work was to locate the north line of the Service patent and re-run and locate the west line of the Machin tract and to check their bearings with the magnetic needle for comparison with their bearings as recorded when originally surveyed. Also to re-run other lines in the vicinity, whose old description had been found, in order to make similar comparisons. These surveys and these investigations showed the north line of the Service's patent to be the best marked and the best defined line in that region; it being re-run for about six miles and found to be marked during a considerable portion of this distance by ancient stone walls and fence lines. It was also known and recognized by the land owners and old residents, as the boundary line between adjacent properties; forming as it does the division line between the forest lands, open pastures and cultivated fields. Having been originally run by the compass, its line is very irregular, but its general course is well defined.

From Anthony Bronson there was obtained a copy of the deed to lot No. 8 of Service's Patent, which lot is the most easterly, having for its northeast corner the northeast corner of the patent itself. The deed reads as follows:

> "Deed to A. S. Wall and others 1826, according to survey made in 1795 by Calvin Guiteau. Beginning at a spruce tree on the bank of Canada creek marked 8.9 and runs from thence north 14 degrees 30 minutes east 20 chains and fifty links to a post standing in the north line of the patent, a beech tree N. E. 7 links marked 7.8, thence S. 75 degrees 30 minutes E. 53 chains along the patent line to a water ash standing near the north bank of Canada creek marked G. B. No. 8 1795, thence down along the bank of said creek to the place of beginning."

This also describes the northwest corner of lot 8, so shown by Anthony Bronson and verified by Daniel Rood; both of whom have lived in this vicinity for more than thirty years.

This corner is now indicated by a post four feet high standing in the fence marking the patent line about 600 feet west of the Twin Rock Bridge road.

The northwest corner of lot 7, which is also on the north line of the patent, was found in a cleared field on a hill 4024 feet west of the northwest corner of lot 8 and about 1800 feet west of a road leading from the village of Remsen to the village of

Hinckley at the intersection of the north line of the patent which is here marked by a broad stone wall, and by the division between lot 7 and lot 6. This intersection is well marked and was used as an instrument station to extend the line through the corner of lot 8 to the bank of Canada creek, on a low, narrow point, around which the creek makes a sharp turn directly at the junction of Black creek.

It was then necessary to intersect this line by the west line of the Machin Tract. From a deed in the possession of J. L. Thomas, of the village of Remsen, the following is copied:

> "Minutes of survey of lot 21 in Machin Tract. Beginning at the S.W. corner of No. 16, a birch sapling cornered and marked 16.21 and runs from thence north 71 degrees east, along a line of marked trees 28 chains 98 links to a beech cornered and marked 16, 17, 21, 22, thence south 19 degrees east along a line of marked trees 34 chains 20 links to a stake 12 links N. E. from beech sapling cornered and marked 21, 26, thence S. 71 degrees W. along a line of marked trees 28 chains 84 links to a stake 8 links E. from a beech cornered and marked 21,26, thence N. 19 degrees W. along a line of marked trees 34 chains 26 links to the place of beginning. Copied from original field book made by Benjamin Wright in 1794."

The birch sapling which originally marked the S. W. corner of lot 16 and the northwest corner of lot 21, as above described, is not now in existence, but the position which it occupied was shown by J. L. Thomas, who remembered it 60 years ago. Removing the brush and logs from the position indicated, there was found a circular heap of stone about three feet in diameter, well bedded in the earth; the vicinity is swampy and otherwise is free from stones. This heap of stone is recognized by the adjacent property owners as marking the corner and as being a point on the west line of the Machin Tract as originally established. About 1,400 feet southerly from this corner a similar heap of stones was found, which is stated by the owner of the land to have been placed there many years ago to mark the northwest corner of the south half of lot 21. Between these points stand the remains of the old Thomas house. According to the testimony of Mr. Thomas, who is now an old man, this house was built by his father 65 years ago and its west side was placed as close as possible to the west line of the Machin Tract. When the transit line was run between the centers of the stone heaps, as described, it was found to cut the Thomas house six inches east of its west side.

Prolonging this line 1,500 feet further south the line was found to intersect a fallen pine on which ancient witness hacks appeared. This pine was identified by Joseph Miller, in whose family the ownership of this lot has been for 80 years, as being one of the original line trees which marked the west line of the Machin Tract and which had been repeatedly used by old surveyors as a landmark. These four points coincided in forming a straight line and this line was accepted as being the west line of the Machin Tract, which was then prolonged to intersect the north line of the Service Patent. This intersection is shown on the map herewith.

Having thus determined the position of the northeast corner of the Service's Patent, this corner was then occupied and the true meridian at the place was determined by observations of Polaris made by Deputy State Engineer Wm. Pierson Judson on July 17th, 1899.

After conference at Washington with Mr. L. A. Bauer the magnetic inspector of the United States coast and geodetic sur-

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vey on July 24th and 25th, 1899, observations were then made to determine the mean magnetic declination at the same point; using the best instrument obtainable (Buff & Berger special transit elsewhere described) and also using the detailed methods of observation approved by the United States coast survey in its most careful work for determination of magnetic declination.

These observations were made on July 29th and July 30th, 1899, at each hour from six a. m. to six p. m. of each day and at each ten minutes between the hours of ten a. m. and eleven a. m. and between the hours of five p. m. and six p. m.

The purpose of these magnetic observations was to obtain the information necessary to enable the magnetic inspector of the United States coast survey to determine by reference to the records of that department what change in magnetic declination had occurred at this point since 1795, in order that the present course of the boundary line which was to be run from this point for fifty-three miles northward should be the same as was the course indicated by the magnetic needle at the same point in 1798, as required by the terms of the law.

The details of these observations are given in the table and the diagrams following and in the accompanying description:

Hourly values of the magnetic declination at the northeast corner of the service patent, taken July 29 and 30, 1899, by H. A. Van Alstyne, first assistant engineer. Instrument used, special Buff and Berger transit, with 4¼-inch needle.

JULY 29.				JULY 30.			
6.00 A. M.	10° 03′	10.00 A. M.	10° 17′	6.00 A. M.	10° 05′	10.00 A. M.	10° 11′
7.00 " "	10° 04′	10.10 " "	10° 15′	7.00 " "	10° 05′	10.10 " "	10° 11′
8.00 " "	10° 05′	10.20 " "	10° 15′	8.00 " "	10° 05′	10 20 " "	10° 10′
9.00 " "	10° 05′	10.30 " "	10° 13′	9.00 " "	10° 12′	10.30 " "	10° 12′
10.00 " "	10° 17′	10.40 " "	10° 18′	10 00 " "	10° 11′	10.40 " "	10° 12′
11.00 " "	10° 15′	10.50 " "	10° 15′	11.00 " "	10° 12′	10.50 " "	10° 12′
12.00 M.	10° 15′	11.00 " "	10° 15′	12.00 M.	10° 15′	11.00 " "	10° 12′
1.00 P. M	10° 16′	5.00 P. M.	10° 12′	1.00 P M.	10° 15′	5.00 P. M.	10° 12′
2.00 " "	10° 16′	5.10 " "	10° 12′	2.00 " "	10° 15′	5.10 " "	10° 15′
3.00 " "	10° 15′	5.20 " "	10° 17′	3.00 " "	10° 15′	5.20 " "	10° 13′
4.00 " "	10° 10′	5.30 " "	10° 17′	4.00 " "	10° 10′	5.30 " "	10° 13′
5.00 " "	10° 12′	5.40 " "	10° 15′	5.00 " "	10° 12′	5.40 " "	10° 10′
6.00 " "	10° 11′	5.50 " "	10° 15′	6.00 " "	10° 13′	5 50 " "	10° 11′
		6 00 " "	10° 11′			6.00 " "	10° 13′

	JULY 29.	JULY 30.
Mean magnetic declination from hourly observations between 6 a. m. and 6 p. m.	10° 11′ 07	10° 11′ 15
Mean magnetic declination from observations taken each ten minutes between 10 a. m. and 11 a. m	10° 14′ 7	10° 11′ 4
Mean magnetic declination from observations taken each ten minutes between 5 p. m. and 6 p. m.	10° 14′ 1	10° 12′ 4

Diagram 1. Shows that at about sunrise the north end of the needle is at its point of greatest easterly elongation,—the magnetic declination being west—has its minimum value of the day. At this time it begins its westerly movement which continues uniformly until 8 a. m.; during the next hour the movement is imperceptible the needle hovering around the same position. It then with rapid motion takes up its westerly progress and at 10 a. m. has reached its point of greatest westerly elongation, having crossed at about 9:30 a. m. its mean position of the day, and having passed during this hour through 12 minutes of arc. Now it gradually and slowly with slight reversals starts back eastward until 3 p. m. when its velocity increases and it once more, about

Graphical representation of the Diurnal Variation of the Magnetic Declination at the north east corner of Service's Patent. July. 1899.

DIAGRAM 1.

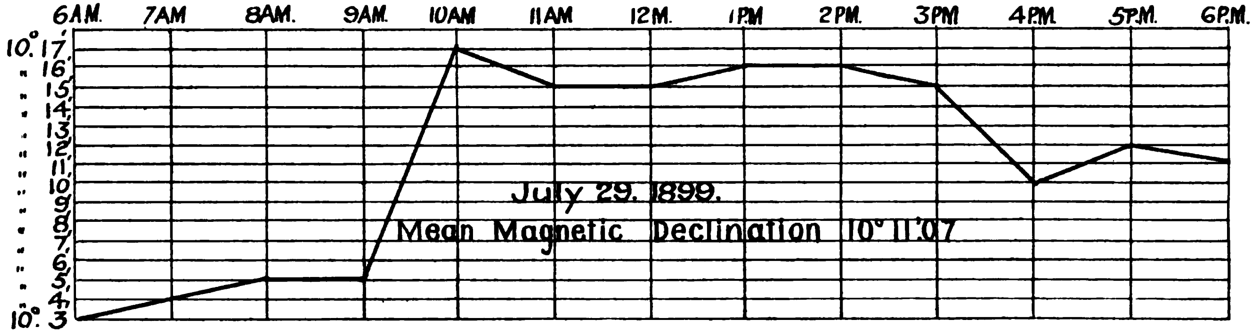
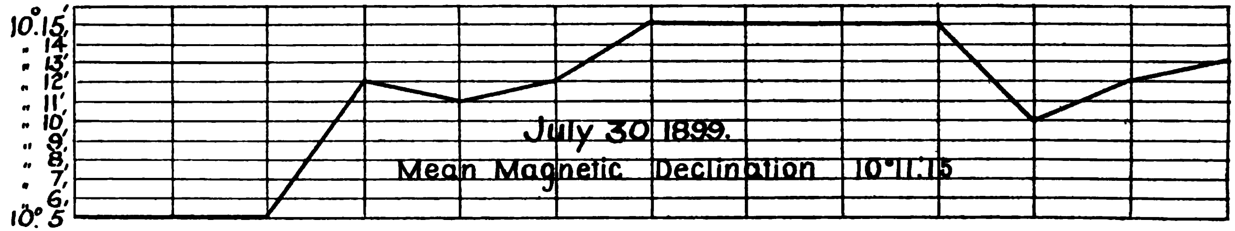


DIAGRAM 2.



3:45 p. m., is at its mean position of the day. After 4 p. m. a slight westerly movement, sufficient to bring the needle to its mean position, recommences and continues until 5 p. m. when with occasional interruptions and stops it starts back on its easterly course to occupy the approximate position it held in the morning.

Diagram No. 2 shows the same general movement of the needle; the chief difference in the two diagrams is in the time at which they show the greatest westerly elongation of the needle to occur. In this diagram the needle is at its easterly limit from about six a. m. to eight a. m.; the westerly movement then begins and continues for the next hour when it turns slightly to the east. At ten a. m. it turns again to the west reaching its point of maximum westerly elongation about noon. From noon until three p. m. the needle clings to this point and then moves quickly to the east and at about four p. m. again turns westerly continuing in this course until about sundown, when it once more turns easterly.

Taking the mean for each day of the hourly observations of the magnetic declination, a close similarity appears. The mean of the readings for July 29th shows the magnetic declination to be 10 degrees 11.06 minutes; for July 30th we have 10 degrees 11.15 minutes or a difference from the previous day of 9-100 of a minute or about 5 seconds. The mean of the observations for the two days gives the magnetic declination at the northeast corner of Service's Patent, July 29 and 30, 1899, as 10 degrees 11.11 minutes west of the true north.

From this corner the north line of Service's Patent has an azimuth of 99 degrees 34.5 minutes, or a bearing from the true meridian of 80 degrees 25.5 minutes west of north. The survey of Calvin Guiteau gave the magnetic bearing of this line in

1795 as N. 75 degrees 30 minutes W. The mean magnetic bearing of this line as observed July 29 and 30, 1899, at the northeast corner of the patent was found to be N. 70 degrees 14.4 minutes W., showing a change in the pointing of the needle since 1795 of 5 degrees 15.6 minutes to the west. The magnetic declination as given above was on July 29 and 30, 1899, 10 degrees 11.11 minutes west of north; subtracting from this quantity the change since 1795 of 5 degrees 15 minutes 37 seconds (or 5 degrees 15.6 minutes) we have 4 degrees 55.5 minutes west of true north as the magnetic declination at the northeast corner of Service's Patent when the north line of the Patent was established in 1795.

The results of the observations were at once used in the field, and the desired course was determined in the same manner as was known would be used by the United States Coast Survey in deciding the matter. This action was necessary to avoid the delay and expense incident to stopping the work of the survey party while these data should be taken to Washington and there considered.

The decision was therefore made in the survey camp, by the Deputy State Engineer and Surveyor, on August 3rd, 1899, and work on the line was at once continued.

The data were prepared for the consideration of Mr. L. A. Bauer, magnetic inspector of the United States coast survey at Washington, under date of August 5th, 1899, with copies of the table and diagrams of the magnetic observations.

A copy of this letter is here given.

EDWARD A. BOND, *State Engineer.*
WM. PIERSON JUDSON, *Deputy State Engineer.*

STATE OF NEW YORK,
OFFICE OF THE
STATE ENGINEER AND SURVEYOR,
ALBANY, *August* 5, 1899.

Subject—LEWIS AND HERKIMER COUNTY LINE.

To the Superintendent of the U. S. Coast and Geodetic Survey, Washington, D. C.:

Sir.—It is desired by Edward A. Bond, State Engineer and Surveyor of New York, to obtain the opinion of your Department regarding the change of magnetic declination which has occurred at the northeast corner of Service's Patent, in the town of Remsen, of Oneida county, N. Y., from the year 1798.5 to the year 1899.5.

Your Department was consulted on this subject on June 15 and on July 25, 1889, when you considered such data as were then known. The subject has been further investigated, with the aid of the valuable advice then received, and representatives of this Department have since been employed to make further examinations of the records of the adjacent counties regarding the old lines in the vicinity, and also to re-run such lines after finding old marks and monuments which had been set to define them.

These investigations have determined that, of the various old lines which have been retraced, including the lines of the Machin tract and of the Jerseyfield Patent and of the De Witt tract, the north line of the Service's Patent is not only the one which is marked with the best defined and best preserved landmarks, consisting of many miles of stone walls and of long-accepted boundary fences, but also that this line is the one most often referred to by the old records as a basis of other surveys in that region.

It is therefore concluded that this line only should be referred to in determining the change of magnetic declination at its east end, which is also the northeast corner of Service's Patent. This line was run by compass bearings in 1795, and is, therefore, not a straight line. Its bearing as observed at its east end is that of the north line of lot 8, prolonged eastward 3,418 feet to intersect the west line of the Machin tract, this intersection determining the corner at which the bearing was taken. This bearing was recorded in 1795 as north 75° 30′ west.

To determine the present mean magnetic bearing of this portion of the line, a Buff & Berger transit reading to twenty seconds and having a four and one-quarter inch needle, was set on the corner during July 29th and July 30th, 1899. Careful observations were made of the needle every hour from 6 a. m. to 6 p. m., and every ten minutes from 10 a. m. to 11 a. m. and from 5 p. m. to 6 p. m. The result of these observations are given in the accompanying tables and in their graphic representations showing the curves of diurnal variation; the mean of these readings giving the bearing of July 29-30, 1899, to be north 70° 14.4′ west.

The purpose of these investigations is the determination of the direction of the boundary line between the counties of Lewis and Herkimer, which line is described as having the direction on which the magnetic needle pointed in the year 1798.5 when the compass used was set at the northeast corner of Service's Patent.

Very respectfully,
WM. PIERSON JUDSON,
Deputy State Engineer.

This letter was not presented to the Superintendent of the Coast Survey at Washington until January 15th, 1900, when the following reply was received giving precisely the same decision which had already been made and used on August 3rd as above described:

TREASURY DEPARTMENT,
OFFICE OF THE COAST AND GEODETIC SURVEY,
WASHINGTON, D. C., *January* 19, 1900.

Mr. EDWARD A. BOND, *State Engineer, Albany, N. Y.:*

Sir.—Referring to your letter of the 15th instant, we take pleasure in giving you the following information:

In your letter dated August 5, 1899, which was transmitted with the one of the 15th instant, and received by this office today, you state that as the result of special investigations of various lines in the vicinity of the N. E. corner of Service's Patent, Remsen, Oneida county, you have come to the conclusion that the north line of Service's Patent is the *only* line in the vicinity which should be referred to in determining the change of magnetic declination at its *east* end.

Assuming this conclusion to be true (and this office has no data indicating otherwise), the change of magnetic declination for the period 1798.5 is obtained as follows:

Magnetic bearing of the north line of Service's Patent at the northeast corner in 1795 75° 30′ W. of N.

The magnetic needle was very nearly stationary between 1790 and 1800, so that the above bearing applies equally well for 1798.5.

Magnetic bearing of same line in 1899, July 29 and 30 from observations made under the direction of W. P. Judson 70° 14′.4 W. of N.

Hence change of magnetic declination, 5°15′.6.

Respectfully yours,
(Signed) HENRY B. PRITCHETT,
Superintendent.

Acting in agreement with the opinion thus expressed, the direction of the line at the northeast corner of Service's Patent was laid off 4° 55.5′ west of the true meridian as determined on July 17, 1899, and this course was thence followed in a straight line for nineteen and two-thirds miles to the beginning of the desired boundary line at the corner of Oneida, Lewis and Herkimer counties near Moose river. This line thus run was an instrumentally straight line; the needle itself being used only to determine its direction at the initial point as has been above described.

The instrument used for running this line was a special Buff & Berger transit with a six and one-quarter inch horizontal graduated circule, with verniers reading to twenty seconds, and with vertical circles having verniers reading to minutes.

The instrument was supported on three leveling screws and a broad leveling base; the telescope magnifying twenty-seven diameters. The instrument was loaned to this department by the Hon. Verplanck Colvin, Superintendent of the State Land Survey, as was also a duplicate instrument which was used in checking the line. The two instruments proved to be very satisfactory and enabled accurate work to be done. The line led through rough and wooded country where most of the surface consisted of the light vegetable mould or "duff," characteristic of the forest region. This material was so light as to yield under the weight of the observer so that in every case three stakes, each about two feet long, were driven into the ground, flush with its surface, to receive the legs of the tripod. With this precaution, the observer was able to move around the instrument without disturbing it. The first sight from the northeast corner of the Service's Patent was made by deflecting from the true meridian, as above described. The next sight and all the succeeding ones were made by setting the instrument over the last stake, turning the telescope back to the stake previously set, and there transiting the glass to a stake ahead as far as the shape of the ground would permit it to be seen. At this point a stake about four inches in diameter and four feet long was then driven into the ground about two feet, the top being sawed off level and smooth. On this top a sight was then taken to the sharp point of a six-H pencil, with which a small mark was made on the top of the stake. The high magnifying power of the instrument permitted the pencil point to be plainly bi-sected at a distance of 1,000 feet. After having obtained one point on the head of the stake, the telescope was reversed sighting back to a brad of the size of a pin on the previous stake and again transiting forward, when another point was put with a pencil on the same stake. At a distance of 500 feet these two points might be from one-eight to one-quarter inch apart, owing to error in the line of collimation; the correct point lying midway between these two points. This operation of back-sighting and reversal was then repeated until eight pairs of observations were made, resulting in eight middle points generally lying within a circle of less than an eighth of an inch in diameter; the mean of these middle points was then taken as the correct line and a brad the size of a pin was driven in the place. These often-repeated observations insured the accuracy of the work and did not delay its progress materially, because much time was necessarily occupied in felling trees and clearing a way through the heavy timber, seven axmen being thus employed. The first 19 2-3 miles north from the Service's Patent corner was run in this way to the Oneida county corner near Moose river at which point the Lewis and Herkimer county line begins. In order to be sure of the correctness of this line as run and that no unconscious divergence had been made, an off-set station was established on the top of Meyer's Hill from which a view was obtained southward across the intervening hills and forests to a station on Barhydt hill two miles south from the Service Patent corner and to the northward eight miles to the Otter Lake hill, which is two miles south from Moose river. These off-set stations were precisely at equal distance from the main line, the distance being measured both ways with a leveled steel tape. At these stations heliotropes were used to reflect the sun's rays and these were observed from the transit instrument mounted on a 50-foot signal station ot the top of Meyer's Hill. The observation was many times repeated and the observer was enabled to detect any deviation from a perfectly straight line; if there had been a deviation of six inches it would have been plainly visible, and it was considered that the deviation, if any, was less than three inches. This confirmation of the correctness of the line, as run, was considered necessary because it is a well established fact that the running of a straight line is difficult.

Mr. H. P. Willis is entitled to much credit for the accurate manner in which he handled the transit and made the observations by which such satisfactory results were obtained.

The line was prolonged from Otter Lake Hill across the Moose river to the second low hill, about 1,600 feet north of the right hand bank of the river looking down stream. It was here found to pass just east, (as below stated) of a granite boulder, about three feet long and two feet wide, having a one-half inch drill hole in the center of the top; through this drill hole are three groves which extend in the direction of each of the county lines of Lewis, Oneida and Herkimer. This stone was placed at this corner by Verplanck Colvin, Superintendent of the Adirondack Survey in 1881, (Page 108, Report of the Survey 1886) at which time he found marked trees which indicated that a line had been run for the east line of the county of Oneida in 1802. (Page 85, Ibid.)

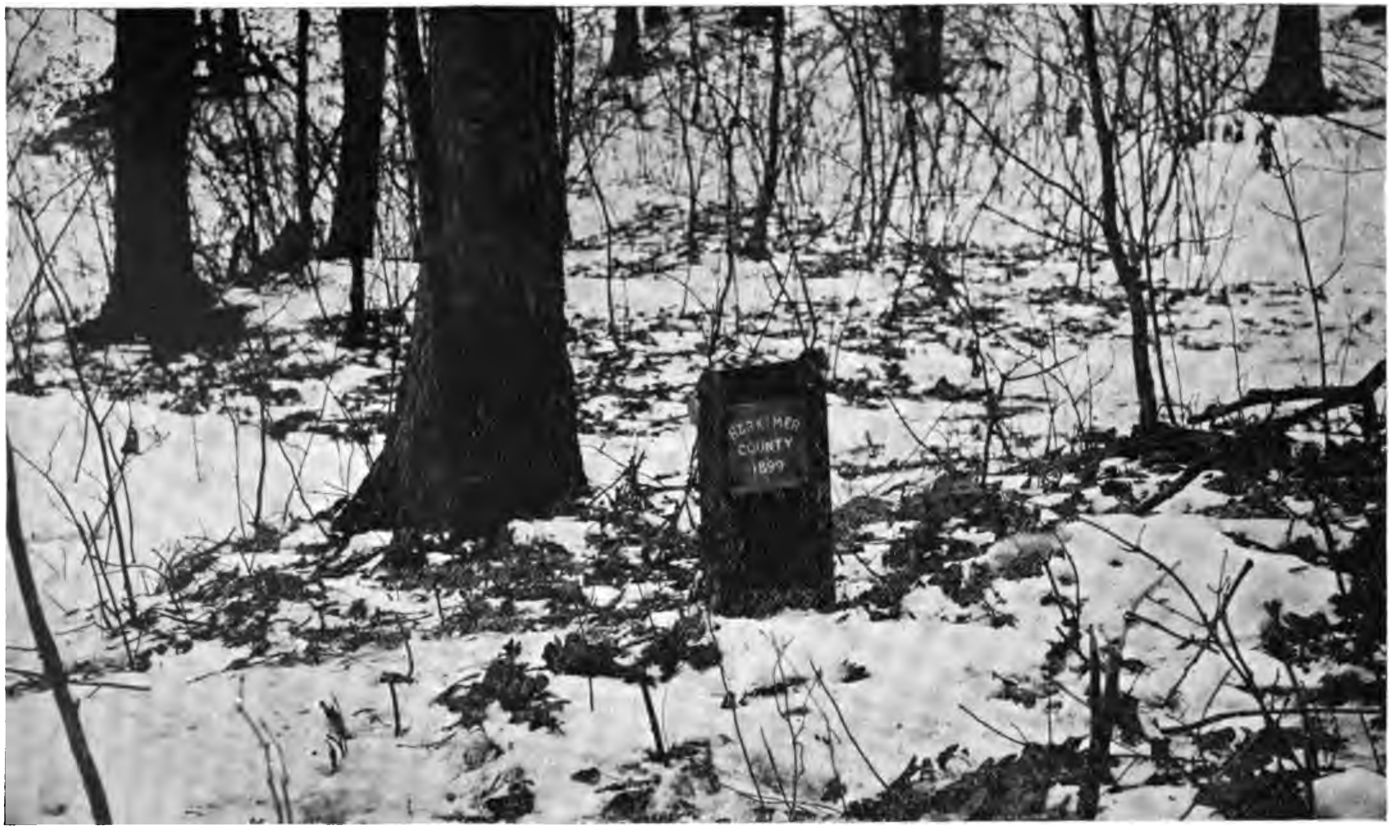
The point upon which Mr. Colvin placed this stone in 1881 is said by D. C. Wood, a local surveyor familiar with that region, to have been previously marked by an old stake dating back 60 years.

The line of the present survey transited from Otter Lake hill passed 5.6 feet to the eastward of the drill hole in this stone. If the line of the present survey had been laid off at its origin 13 seconds further westward, the line would have intersected the center of the stone. In view of the evidences of reliability of the corner as marked by the stone and of the fact that it had so long been accepted as the true corner, it was deemed best to correct the course of the line of the present survey 13 seconds and to accept this monument as marking the correct corner of the three counties. The instrument was therefore set over the center of the stone and by a corrected back-sight to the station on Otter Lake hill two miles southward, the course northward of the Lewis and Herkimer county line was determined; it thus being the same line which would have been run if it had been possible to set an instrument at the northeast corner of Service's Patent, about twenty miles southward, and to have sighted across the intervening distance to the Moose River monument and then to have prolonged the same line northward to the St. Lawrence county line. The course of the corrected line thus run being 4° 55.7′ west of the true meridian at the N. E. corner of the Service Patent.

From this point northward the same process of transiting the line was continued; the length of sights varying from 100 feet to 1,000 feet and in every case being as long as the irregularity of the rough country would permit.

Meantime monuments had been prepared for marking the line which monuments differ radically from any which have before been set. It was impracticable to use the ordinary stone monuments, because the rough and inaccessible character of the country made it necessary that each monument must be carried many miles through the forest on men's shoulders. It was considered that the forest fires so prevalent in this region would destroy any stone monuments which chanced to be in the areas burned over. Each monument set was therefore made of a steel I-beam having a five-inch web and three-inch flanges; each monument was five feet long and had a steel plate twelve inches square and one-quarter inch thick, riveted to its base. The top of each monument was rounded off and on the opposite faces of the web were riveted four-inch by four-inch cast brass plates with the name of the county and the year of the survey. The plates being nickle-plated and being riveted to the beam. These monuments were set four feet in the ground and in digging the holes to set them, the light vegetable " duff " was carried away and the hole around the monument filled with earth and gravel and sand brought, in some cases from considerable distance, in order to insure their permanence. The center of the top of each monument is indicated by a small notch, to which its distance from the Moose river corner was measured with steel tape corrected for slope. This distance and the number of the monument is in each case stamped in a nickel-plated copper button one and one-quarter inches in diameter, which button is riveted into a half-inch hole in the south flange of the monument. Before setting each monument, its exact center was first marked by a earthen-ware saucer buried in the ground beneath its base.

Lewis and Herkimer County Line Monument.



Lewis and Herkimer County Line Monument.

These monuments were set at average intervals of four-tenths of a mile or about two and one-half monuments per mile, the general appearance being shown by the accompanying photographs.

Seventy such monuments were thus set on the total length of the line, which is thirty-three and three-eighths miles in length.

At nine points on this line, ledge rock was found which made it impossible to set the monuments, and at these points there were drilled into the rock, holes one and three-quarter inches deep and three-quarters of an inch in diameter, in which there were set, in Portland cement, nickle-plated copper bolts one and three-quarter inches in diameter, each bearing the same inscription. This inscription reads "Lewis County 1899"; "Herkimer County 1899"; "No. —; miles" —.

In order to expedite the work and also to check its accuracy, it was necessary to have two parties: The first party running the line and leaving it marked by stakes, as above described. The second party following a few miles after them and using a precisely similar instrument to check the accuracy of the line, at the same time measuring it with a standard steel tape line with measurements corrected for slope, and setting monuments as has just been described at selected points along the line, always using a point whose corrected distance was an exact even decimal of a mile.

In the instrument work of the second party the feet of the tripod of the instrument were set on the same hubs in the ground which were placed for the other instrument; two observers making the sights: One making the back-sights and transiting the instrument for the other to make the fore-sights; thus making the complete observation without the observers moving their feet and without any chance of disturbing the instrument. This method gave very close results, as was to be expected.

It was the duty of the second party in case any error however slight should be found in the line, to at once send on and notify the leading party who would then return and determine and correct the error. No error was however found.

As a final check upon the correctness of the line, an observation was made of Polaris, at the extreme north end of the line, where it intersected the St. Lawrence county line. The direction of the line was thus found to be exact within the limits of the instrument. The course of the St. Lawrence county was traced for several miles each side of the intersection, by Mr. James McKee, a local surveyor familiar with the region who found the line plainly marked by old blazed trees, whose rings of annual growth show that the marks were made in 1794. The intersection was marked by a special monument made of two I-beams riveted together to form the angle at which the lines intersect, and marked with three brass plates, each bearing the name of the county toward which it faces.

The following table is given showing the number, character and location of the monuments and also a detailed description of each monument with the witness points surrounding it.

The accompanying map and profile shows the topography along the line and the positions of the monuments:

List of monuments marking the boundary line between the counties of Lewis and Herkimer, showing the location of the monuments, the magnetic and true bearing at each monument and the magnetic declination at each monument.

Monument.	Distance from S. E Corner of Lewis Co.	Date and Time of Reading of Needle.		Bearing of Line Degrees and Minutes.		Magnetic Declination or Variation of the Needle.	REMARKS.
No.	Feet.	Date.	Time.	Magnetic.	True.		
			h. m.	° ′	° ′	° ′	
0	00	Sept. 24	10.00 A. M.	N. 7 22 E.	N. 4 57 W.	N. 12 19 W.	Granite boulder set in 1881; used as initial monument of this survey.
1	2,957	" 24	6 00 P. M.	N. 5 32 E.	N. 4 57 W.	10 29 W.	In hard wood timber 75 ft. south of wedge shaped rock.
2	5,280	" 25	11.00 A. M.	N. 5 01 E.	N. 4 57 W.	9 58 W.	In clear beech timber on flat.
3	7,234	" 25	12.30 P. M.	N. 5 13 E	N. 4 57 W.	10 10 W.	In hard wood timber 200 feet south of large windfall.
4	10,771	" 28	1.30 P. M.	N. 5 18 E.	N. 4 57 W.	10 15 W.	In thick spruce and beech timber 400′ S. John Brown's tract road.
5	11,035	" 28	3.20 P. M.	N. 5 18 E	N. 4 57 W.	10 15 W.	In second growth timber 15′ N. of John Brown's tract road.
6	13,306	" 29	1.30 P. M.	N. 5 50 E.	N. 4 57 W.	10 47 W.	In open beech woods 75′ S. of old wooden-track railroad.
7	15,892	" 30	12.45 P. M.	N. 5 21 E.	N. 4 57 W.	10 18 W.	In hardwood timber near several large birch trees.
8	17,424	" 30	2.30 P. M,	N. 5 39 E.	N. 4 57 W.	10 36 W.	In beech and birch woods 30′ S of Abbey road.
9	18,586	Oct. 1	1.00 P. M.	N. 5 29 E.	N. 4 57 W.	10 26 W.	On thick spruce knoll 200′ S. of long tamarack swamp.
10	20,697	" 1	5.00 P. M.	N. 5 30 E.	N. 4 57 W.	10 27 W.	In clump of large soft maples on birch ridge.
11	24,077	" 2	11.30 A. M.	N. 5 20 E.	N. 4 57 W.	10 17 W.	In second growth, corner of conical knoll N. W. corner.
12	26,912	" 3	10.30 A. M.	N. 5 27 E.	N. 4 57 W.	10 24 W.	In beech and birch woods on S. of Middle Branch creek.
13	29,093	" 3	3.00 P. M.	N. 5 19 E.	N. 4 57 W.	10 16 W.	In very thick woods 20′ N. of S. edge of flat.
14	31,527	" 4	10.25 A. M.	N. 5 46 E.	N. 4 58 W.	10 44 W.	In thick scrubby hard wood timber.
15	34,320	" 4	4.00 P. M.	N. 6 35 E.	N 4 58 W.	11 33 W.	In heavy beech and birch timber 25′ N. of large boulder.
16	36,854	" 5	9.15 A. M.	N. 5 27 E.	N. 4 58 W.	10 25 W.	In very thick beech and birch woods ¼ mile S. of Otter lake.
17	38,332	" 5	11.00 A. M.	N. 5 40 E.	N. 4 58 W.	10 38 W.	In thick scrubby spruce woods on bank of Otter lake.
18	39,072	" 5	12.00 M.	N. 5 48 E.	N. 4 58 W.	10 46 W.	In second growth timber 14 ft. N. of Otter Lake road.
19*	42,293	" 6	9.15 A. M.	N. 6 35 E.	N. 4 58 W.	11 33 W.	In open second growth beech and birch in centre of sloping rock.
20	45,408	" 6	2.00 P. M.	N. 6 33 E.	N. 4 58 W.	11 31 W.	In thick beech woods near several very large birch trees.
21	47,520	" 6	4.00 P. M.	N. 7 54 E.	N. 4 58 W.	12 52 W.	In thick beech woods on side hill 600 ft. S. of high summit.
22	50,371	" 7	11.30 A. M.	N. 6 14 E.	N. 4 58 W.	11 12 W.	In thick beech woods, on small ridge 400 ft. N. of very high summit.
23	53,170	" 7	2.00 P. M.	N. 5 52 E.	N. 4 58 W.	10 50 W.	In thick spruce woods in low ground.
24	55,598	" 8	10.00 A. M.	N. 7 48 E.	N. 4 58 W.	12 46 W.	In thick beech woods on high summit, 600 ft. S. of Silver mine.
25	58,645	" 8	3.00 P. M.	N. 5 37 E.	N. 4 58 W.	10 35 W.	One mile S. of Independence river, near small boulders.
26	60,826	" 8	1.30 P. M.	N. 5 30 E.	N. 4 58 W.	10 28 W.	1,100 ft. S. of Independence river, at foot of the balsam flats.
27	63,782	" 9	4.00 P. M.	N. 5 33 E.	N. 4 58 W.	10 31 W.	In open birch and spruce woods 1,500 N. Independence.
28	65,261	" 10	8.00 A. M.	N. 5 33 E.	N. 4 58 W.	10 31 W.	In open hard wood timbor 20 ft. N. of Independence road.
29	68,671	" 10	11.00 A. M.	N. 6 34 E.	N. 4 58 W.	11 32 W.	In thick second growth timber 25 ft. S of 4th Creek road.
30*	71,364	" 10	3.00 P. M.	N. 5 19 E.	N. 4 58 W.	10 17 W.	In open second growth timber, on flat rock 25 feet square.

List of monuments, etc.—(Continued).

Monument.	Distance from S. E. Corner of Lewis Co.	Date and Time of Reading of Needle.		Bearing of Line Degrees and Minutes.		Magnetic Declination or Variation of the Needle.	REMARKS.
No.	Feet.	Date.	Time.	Magnetic.	True.		
			h.m	° ′	° ′	° ′	
31	73,973	Oct. 11	9.00 A. M.	N. 6 25 E.	N. 4 58 W.	11 23 W.	On North edge of small knoll.
32	76,771	" 11	12.00 M.	N. 6 16 E.	N. 4 58 W.	11 14 W.	On narrow ridge in heavy birch timber.
33	78,820	" 11	3.00 P. M.	N. 5 34 E.	N. 4 58 W.	10 32 W.	In open timber on side hill, near several hemlock stumps.
34	81,734	" 12	11,00 A. M.	N. 3 00 E.	N. 4 58 W.	7 58 W.	In thick spruce and balsam grove. Many granite boulders.
35	83,281	" 12	1.00 P. M.	N. 4 54 E.	N. 4 58 W.	9 52 W.	In clear beech woods on high summit, S. of Beaver river.
36	87,120	" 12	4.30 P. M.	N. 5 18 E	N. 4 58 W.	10 16 W.	In heavy beech timber ¾ mile S. of Beaver river.
37	90,119	" 13	11.00 A. M.	N. 5 38 E.	N. 4 58 W.	10 36 W.	35 ft. south of road from Fenton's to Still Water.
38	92,030	" 13	1.30 P. M.	N. 6 02 E.	N. 4 58 W.	11 00 W.	On western slope of hard wood ridge ¼ mile S. Beaver river.
39	93,451	" 13	3.00 P. M.	N. 6 26 E.	N. 4 58 W.	11 24 W.	25 ft. S. of Beaver river near overhanging hemlock.
40	93,826	" 13	4 00 P. M.	N. 6 17 E.	N. 4 58 W.	11 15 W.	In thick underbrush 125 ft. N. of Beaver river.
41	96,767	" 14	10.00 A. M.	N. 5 59 E.	N 4 58 W.	10 57 W.	25 ft. N. of road from Fenton's to Mosher Ponds.
42	99,370	" 14	9.00 A. M.	N. 7 50 E.	N. 4 58 W.	12 48 W.	On side of hill.
43*	99,602	" 14	9.00 A. M.	N. 7 50 E.	N. 4 58 W.	12 48 W.	On south edge granite bluff.
44*	101,634	" 15	10.30 A. M.	N. 5 28 E.	N. 4 58 W.	10 26 W.	On granite bluff about 40 ft. below summit.
45*	104,401	" 15	3.00 P. M.	N. 5 18 E.	N. 4 58 W.	10 16 W.	On top of granite ridge about 600 ft. S. of Ike's pond.
46*	105,563	" 16	10.00 A. M.	N. 5 12 E.	N. 4 59 W.	10 11 W.	On granite boulder 25 ft. N. W. of Ike's pond.
47	108,203	" 16	2.00 P. M.	N. 5 25 E.	N. 4 59 W.	10 24 W.	On top bluff in burnt district.
48*	111,144	" 17	9.00 A. M.	N. 5 45 E.	N 4 59 W.	10 44 W.	On granite rock 55 ft. W. of Kettlehole falls, Alder creek.
49	112,200	" 17	11.00 A. M.	N. 6 25 E.	N. 4 59 W.	11 24 W.	15 ft. N. of road from camp to Belfort in swampy ground.
50*	113,768	" 17	1.00 P. M.	N. 5 58 E.	N. 4 59 W.	10 57 W.	On granite rock, on top bluff, about 1,500 ft. N. of Alder creek.
51	116,503	" 17	4.00 P. M.	N. 5 02 E.	N. 4 59 W.	10 01 W.	On the West end of a small ridge running E. and W.
52	119,174	" 19	4.00 P. M.	N. 8 04 E.	N. 4 59 W.	13 03 W.	On summit of a high beech ridge.
53	121,445	" 19	12.00 M.	N. 5 18 E.	N. 4 59 W.	10 17 W.	In small sink hole in heavy open beech and birch timber.
54	124,238	" 19	2.30 P. M.	N. 6 41 E.	N. 4 59 W.	11 40 W.	On side hill about ¼ mile S. of road to Strife camp.
55	126,667	" 20	4 30 P. M.	N. 5 40 E.	N. 4 59 W.	10 39 W.	In open beech woods 6 ft. S. of road to Strife camp.
56	129,750	" 20	11.00 A. M.	N. 6 04 E.	N. 4 59 W.	11 03 W.	In hard wood timber; ground slopes Westward.
57	132,581	" 20	3.00 P. M.	N. 5 45 E	N. 4 56 W.	10 44 W.	On North edge of high bluff.
58	134,640	" 20	8.30 A. M.	N. 5 54 E.	N. 4 59 W.	10 53 W.	On summit of small knoll.
59	136,382	" 21	10.00 A. M.	N. 5 35 E.	N. 4 59 W.	10 34 W.	In low marshy ground 30 ft. S. of W. Branch Oswegatchie river.
60	137,222	" 21	11.00 A. M.	N. 6 02 E.	N. 4 59 W.	11 01 W.	On a thick spruce ridge 8 ft. W. of road.
61	140,036	" 21	2.30 P. M.	N, 5 02 E	N. 4 59 W.	10 01 W.	On level spot 15 ft. S. of summit of small knoll.
62	142,877	" 22	9.00 A M.	N. 6 10 E.	N. 4 59 W.	11 09 W.	In thick forest, mostly small trees.
63	144,302	" 22	10.00 A. M.	N. 6 19 E.	N. 4 59 W.	11 18 W.	In beech and birch woods 20′ N. road from Long pond to Camp No. 1.
64	145,200	" 22	11.20 A. M.	N. 6 17 E.	N. 4 59 W.	11 16 W.	On Northern slope in clean beech woods.

65		147,682	"	22	2.30 P. M.	N. 6 23 E.	N. 4 59 W.	11 22 W.	In beech woods about 1,500 ft. S. E. of Crimmens' camp.
66		150,163	"	24	9.30 A. M.	N. 5 40 E.	N. 4 59 W.	10 39 W.	On level summit in S. edge of old windfall.
67		153,051	"	24	1.30 P. M.	N. 6 23 E.	N. 4 59 W.	11 22 W.	In old burning 12 5t, S. of road to Crimmens' camp.
68		155,602	"	24	3.15 P. M.	N. 6 25 E.	N. 4 59 W.	11 24 W.	On Southern slope 30′ S. of summit of small knoll.
69		158,374	"	25	10.00 A. M.	N. 6 17 E.	N. 4 59 W.	11 16 W.	In hard wood timber 12 ft. N. of road from Harrisville to No. 1 camp.
70		161,066	"	25	1.00 P. M.	N. 6 57 E.	N. 4 59 W.	11 56 W.	On Northern slope 30 ft. E. of large ledge of rocks.
71*		163,374	"	25	3.30 P. M.	N. 5 36 E.	N. 4 59 W.	10 35 W.	On rock 75 ft. S. of road from Francis camp to Harrisville.
71½		163,437	Nov.	6	12.30 P. M.	N. 5 38 E.	N. 4 59 W.	10 37 W.	On South side of road from Francis camp to Harrisville.
72		165,686	Oct.	26	11.30 A. M.	N. 6 04 E.	N. 4 59 W.	11 03 W.	On small level spot on high summit,
73		167,292	"	26	2.00 P. M.	N. 5 39 E.	N. 4 59 W.	10 38 W.	On S. bank of Oswegatchie river, 10 ft. from edge.
74		167,365	"	26	3.00 P. M.	N. 5 39 E	N. 4 59 W.	10 38 W.	On high bank 10 ft. N. of Oswegatchie river.
75		168,960	"	26	4.00 P. M.	N. 5 50 E.	N. 4 59 W.	10 49 W.	In spruce hollow 1,534 ft. N. of Oswegatchie river.
76		171,885	"	28	4 00 P. M.	N. 5 41 E.	N. 4 59 W.	10 40 W.	On hard wood ridge of N. edge of 150 ft. level ground.
77		174,240	"	30	9.30 A. M.	N. 5 40 E.	N. 4 59 W.	10 39 W.	In open forest of hard wood with some spruce and hemlock.
78		175,380	Nov.	5	3.00 P. M.	N. 5 48 E.	N. 4 59 W.	10 47 W.	On south edge of small knoll.
79		176,205	"	4	3.00 P. M.	N. 3 14 E,	N. 4 59 W.	8 13 W.	On steep sharp side hill 110 ft. S. of Mink creek on St. Lawrence co. line.

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* Copper button.

It is considered that this line will be of great value to surveyors and land owners of this region, who can at any of its monuments determine their distance from any given point along the line and can use it as a base line for any desired surveys in the region. The table also includes magnetic observations taken at each of the monuments which may be of use to surveyors desiring to use the compass. If the compass is kept at a distance of one rod from the monument, the needle will not be affected by the steel beam forming the monument.

The State Engineer has the highest appreciation of the skill and energy and interest shown by Assistant Engineer, C. H. Flanigan who successfully conducted the work to its completion.

CONCLUSION.

In closing this Annual Report I desire to express my appreciation of the courtesy extended to me by the Governor and all of the State officers with whom I have been intimately associated for the past year, and of the able and efficient aid always so cheerfully given me by all of the employees of this Department in connection with their work.

Respectfully submitted.

EDWARD A. BOND,

State Engineer and Surveyor.

APPENDICES.

Boundary Line, New York and Vermont and New York and New Jersey.

September 30, 1899.

HON. EDWARD A. BOND, *State Engineer and Surveyor;*

Dear Sir.—I have the honor to submit herewith a detailed report of my examination of the boundary line monuments between the States of New York and Vermont and the States of New York and New Jersey.

Detailed description of the location of monuments in the boundary line between the States of New York and Vermont, from the northwest corner of Massachusetts to the Poultney river.

MONUMENT No. 1.

This stone is a piece of blue slate, roughly set up in a heap of field stones, on the brow of a high hill descending to the west, on the lands of William Moon, about two and one-half miles east of South Petersburg, N. Y.; this point is in the woods and not readily found; the heap of field stones are about a foot and a half high; a beach tree of eight inches diameter grows from the side of the stones and a pole is fastened to it by an iron band; this pole shows above the trees from the house of Mr. Moon; the stone is marked on the west side "N. Y." and on the east side " V "; a suitable monument should be placed here.

MONUMENT No. 2.

A hewn marble stone marked on one side "New York 1813" and on the other side "Vermont 1813" on the north side of highway leading out of Hoosic into Pawnal. This stone was found on the ground about 25 feeet from the bridge abutment and 10 feet from the water and nearly covered with stone and rubbish. Its proper position should be determined and stone reset.

MONUMENT No. 3.

Described as a large roundish rock on the northeasterly bank of the Hoosick river. There is absolute no certainty about this point. There is an end of a limestone knoll projecting out to the water's edge, and worn round by ice. It is just south of the north track of the Fitchburg railroad, which at this point cuts through the knoll. The line should be rerun and a suitable monument placed.

MONUMENT No. 4.

A blue slate stone at the southwest corner of the town of Bennington; this stone is of rough, irregular shape about 4 feet by 17 inches and 6 inches thick and standing in a brush fence on the lands of George Potter about one-half mile northwest from Potters house on west slope of hill and 10 feet from stump of dead maple. The initials " P " and " B " are roughly cut upon it.

MONUMENT NO. 5.

A hewn marble stone set upon the highway leading from Hoosick Corners to Bennington. This stone is 18 inches wide, 3 inches thick and projects 2 feet 2 inches from the ground; the top, including inscription, is broken off and it leans to the east. It stands in a line fence between the lands of George Wilcox and D. Brimmer and about 100 feet north of the present highway and 50 feet north of a large elm tree. A new stone is required.

MONUMENT No. 6.

A hewn marble stone marked on the west side "New York 1813" and on the east side "Vermont 1813" and set up on the southwest side of a highway leading from Hoosick Corners to North Bennington. This stone is 18 inches wide, 3½ inches thick and 2 feet 2 inches above the ground and is on the southeast side of the highway on the lands of the Burden Iron Company. The top is broken off, the inscription nearly gone and the stone leans to the east and south. A new stone is required.

MONUMENT No. 7.

A white marble stone at the northwest corner of the town of Bennington and the southwest corner of the town of Shaftsbury and Marked "Bent^{n} N. W. corner." This stone is 10 inches wide and 9 inches thick and projects 2 feet above the ground; the top and corners are chipped and leans to the north and west and is in a fence on the lands of Jesse Allen about 350 feet north of the foot of the hill and 175 feet north of a large elm tree on the line.

MONUMENT No. 8.

A hewn marble stone marked on one side "New York 1813" and on the other "Vermont 1813" on the highway leading out of Hoosick into Shaftsbury, near the house of Jesse Allen. This stone formerly stood on the south side of the highway and was found on the north side laying in the door yard of Jesse Allen's house. The stone is 18 inches wide, 3 inches thick and in good condition and should be reset. It is reported that this stone was removed by the electric railway when building their line.

MONUMENT No. 9.

A hewn marble stone marked "New York and Vermont State Line, seventy-five rods to Elias Huntington's stone factory" and set up at the north side of the highway leading from Shaftsbury to White Creek. This stone is from 15 to 24 inches wide and 3 inches thick and about 6 feet above ground. It is at the junction of the above-mentioned road and a road running south on the State line to Jesse Allen's house. It is at fence dividing lands of Patrick Ryan and James Peters. It is nearly down and should be reset.

MONUMENT No. 10.

A hewn marble stone set up on the north side of a highway running out of Cambridge to Shaftsbury at the northwest corner of the orchard nearest the dwelling of, and on the lands of, Harmon Niles. This stone is 16 inches wide, 3½ inches thick and 2 feet, 10 inches above ground; the top including the inscriptions is broken off and it leans badly to the north and west. A new stone is required.

MONUMENT No. 11.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a highway leading from Shaftsbury into White creek. This stone is 14 inches wide, 3 inches thick and 3 feet 3 inches above ground and is in fence deviding lands of Benj. Smith and Frank Fuller. The top of stone is somewhat broken and lettering nearly obliterated. It needs no immediate attention.

MONUMENT No. 12.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a highway leading out of Cambridge into Arlington. This stone is 15 inches wide, 3 inches thick and projects 3 feet and 1 inch above ground, leaning a little to the east. It is at the southeast corner of a cemetery where a lane leads north to Joseph Sprague's house. The lettering is partially gone. No immediate attention is required.

MONUMENT No. 13.

A common stone marked "N" and "V" on the northwest side of highway leading out of Cambridge into Arlington. This stone was not found. Mr. John Baldwin, who has lived for fourteen years on the place, says he has never seen it and he was told it was used in repairing fence some years ago. The line should be re-run and a suitable monument furnished.

MONUMENT No. 14.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a highway leading out of Cambridge into Arlington and on the lands of Wilbur Brown. This stone is 15 inches wide, 4 inches thick and projects 3 feet 2 inches above ground and leans to the west about 20 inches. On line and about 50 paces is an oak tree. The stone is chipped about the top and needs relettering and resetting.

MONUMENT No. 15.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a highway leading from Arlington to Cambridge. This stone is 18 inches wide, 10 inches thick and 3 feet above ground, and is just east of the residence of David Law. No attention is required.

MONUMENT No. 16.

Located at the southwest corner of the town of Sandgate and the northwest corner of the town of Arlington in Vermont. This point is near the top of a steep mountain covered with woods and the point was not definitely located; a brush fence between the lands on David Garey in Sandgate and Mr. Patrick Garey in Arlington is considered the town line and a fence on the State line between Mrs. Garey and Arthur White, in town of Salem, was used to locate the point. The line should be re-run and a suitable monument furnished.

MONUMENT No. 17.

A hewn marble stone, marked on the west side " New York 1814 " and on the east side " Vermont 1814 " set up on the north side of highway leading out of Sandgate into Salem. This stone is 16 inches wide, 6 inches thick and about 3 feet above ground; it leans to the south at an angle of 60 degrees and needs relettering and resetting and is in fence dividing the lands of David Richards and George Peck; it is on the road called the Camden road.

MONUMENT No. 18.

A hewn marble stone, marked on the west side " New York 1814 " and on the east side "Vermont 1814" and set up on the north side of a highway leading out of Sandgate to Salem. This monument is 13 inches wide, 4 inches thick and projects 20 inches above ground. The top is broken and chipped and it leans to the east. It is at the fence dividing the lands of Martin Collins and Patrick McGarvey on the "Beattie Hollow" road. A new stone should be placed here.

MONUMENT No. 19.

A hewn marble stone, marked on the west side " New York 1814 " and on the east side "Vermont 1814" and set up on the north side of a highway leading out of Sandgate into Salem. This stone is 13 inches wide, 4 inches thick and 3 feet 3 inches above ground, and is at the division fence between the lands of

James Wilson and Josiah Barnett on the "Perkins Hollow" road. No attention is required. This stone was reset by the farmers living near, about seven years ago, and may not be on the line.

MONUMENT No. 20.

This monument at the northwest corner of the town of Sandgate and the southwest corner of the town of Rupert we failed to find. It is located on the slope of a wooded hill descending to the east and south on the lands of Stephen Hopkins and is described as one layer of field stone about three feet in diameter; a fence on the State line leads north, part way to this point, from Monument No. 19.

MONUMENT No. 21.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the northwest side of the Vermont turnpike road leading from Salem to West Rupert. This stone is 17 inches wide, 9 inches thick and 3 feet above ground and is on the lands of John Sheldon, about one mile west of West Rupert village. No attention is required.

MONUMENT No. 22.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up near the southwest side of a highway leading northwest out of Rupert into Hebron. This stone is 16 inches wide, 3½ inches thick and projects 15 inches above ground and stands 17 paces southwest of the present highway, in a poplar grove. This point is about one-half mile northwest of the railroad crossing and over the pitch of the hill. It requires no attention.

MONUMENT No. 23.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the south side of a highway leading out of Rupert into Hebron. This stone is 14 inches wide, 3 inches thick and 3 feet above ground. It leans to the north and west about 15 inches and stands at the fence dividing the lands of Spencer Shaw and M. Purclee. This point is about 1¼ miles west of the railroad crossing over the pitch of the hill. It needs resetting.

MONUMENT No. 24.

This monument consists of a few field stones on the lands of Merrit C. Borden on the Vermont side of the State line and locates the northwest corner of the county of Bennington and the southwest corner of Rutland county; this point is on his wood land and no conspicuous mark is near. Mr. Borden has promised to place a tell-tale piece of 6-inch marble at this place. A suitable monument should be furnished.

MONUMENT No. 25.

This monument in the report of 1893 is reported as not found and as having been gone at least five years. No effort was made to locate it. The line should be re-run and a suitable monument furnished.

MONUMENT No. 26.

A hewn marble stone, marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the northwest side of a highway leading southwest out of the village of West Pawlet, near the residence of W. W. Burdick. This stone is 14 inches wide, 5½ inches thick and 2 feet above ground, and 2 feet from a large maple tree. No attention required.

MONUMENT No. 27.

A hewn marble stone marked on the west side "New York State Line 1813" and on the east side "Vermont State Line 1813" and set up on the east side of a highway leading north out of the village of West Pawlet in front of the house of Whalen Johnson. This stone is 18 inches wide, 3½ inches thick and projects 3 feet above ground and requires no attention.

MONUMENT No. 28.

A hewn marble stone marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a former highway leading out of Granville into Pawlet. This stone is 15 inches wide, 4 inches thick and 2 feet 2 inches above ground; leans to the west at an angle of 45 degrees and is about 250 feet north of the north side of the present highway between the lands of William Baker and John Williams. It requires resetting.

MONUMENT No. 29.

A hewn marble stone marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the north side of a highway leading eastwardly from the village of Granville on the lands of Joseph Safford. This stone is 17 inches wide, 7 inches thick and 3 feet above ground, and stands vertically; the lettering is illegible and should be recut.

MONUMENT No. 30.

This monument consist of a rough slate stone about two feet wide, 5 inches thick and standing 18 inches out of the ground;

leaning to the west on the lands of Joseph Safford and about 60 rods north of monument No. 29, and 5 feet easterly of the State line. The former stone fence and witness hickory tree have been removed. No marking was legible. A suitable monument should be placed here.

MONUMENT No. 31.

Described as a large flat stone set in the ground and marked "M 41" and to be situated on the east side of highway leading from Granville into Wells township. This monument was not located; a stone wall of slate and hard heads fences the highway 40 rods each way from its supposed location on the lands of John Cavanaugh, and a thorough search failed to find it; no information could be obtained from house near.

MONUMENT No. 32.

A hewn marble stone marked on the west side "New York 1814" and on the east side "Vermont 1814" on the northwest side of turnpike leading from Granville to Hubbardton. This stone is 16 inches wide, 9 inches thick and is 3 feet above ground and leans to the east about 12 inches from the perpendicular and is adjoining the lands of Francis Hammond. It needs resetting.

MONUMENT No. 33.

A hewn marble stone marked on the west side "New York 1814" and on the east side "Vermont 1814" and set up on the east side of a highway leading south from Poultney to Middle Granville; this stone is 17 inches wide, 11 inches thick and projects 3 feet above ground; leans some 15 inches to the east and needs resetting and relettering. It stands on the land of Mrs. McDonald.

Detailed Description of the Location of Monuments on the Boundary Line Between the States of New York and New Jersey, from the Hudson River to the Delaware River.

EASTERN TERMINAL MONUMENT.

The monument at the eastern terminus of the line is a large block of trap rock 7 feet 6 inches long, 3 feet 2 inches high and about 4 feet thick. It is located at the foot of the Palisades, about 6 inches above the storm tides of the Hudson river, 50 feet north of the south end of a slough and about 800 paces south of a small stream which falls over the Palisades. It is marked with a groove upon its perpendicular eastern face for its full height at a distance of 2 feet south from its northerly end, and is further marked with the words "Latitude 41 degrees north," and on the north side of the groove the words "New York," and on the south side thereof the words "New Jersey." It lies 313.21 feet south 18 degrees 44 minutes west from the United States Coast Survey station Duer, and from the determinations of that survey it is in latitude 40 degrees 59 minutes 48.17 seconds north longitude 73 degrees 54 minutes 11 seconds west from Greenwich. The lettering on the rock is very indistinct and should be recut.

EASTERN WITNESS OR REFERENCE MONUMENT.

This monument is 488 feet from the terminal monument on the bank of the Hudson river and is 350 feet above tide level. It stands opposite a point on the Hudson River railroad about midway between Dobbs Ferry and Hastings, and the boundary line, if extended across the Hudson, would cross the railroad near the tall, old chimney south of Hastings. By clearing away bushes in its immediately vicinity, the monument would be in plain sight of the east bank of the Hudson river from Sing Sing almost to Yonkers. The monument is in one piece, 11½ feet long and with a cross section of something over 1 x 2 feet. It weighs nearly 3 tons, and is set 4 feet down in an accurately cut hole in the rock and fastened with cement mortar, and is further supported for a foot and a half more by building stones and hydraulic mortar around it. The remaining portion (6 feet) is hammered, dressed and marked on two sides; the words "Boundary monument" and the date "1882" are cut on both sides. The north side is further marked:

NEW YORK:
HENRY R. PIERSON,
CHAUNCEY M. DEPEW,
ELIAS W. LEAVENWORTH,
Commissioners.
H. W. CLARKE,
Surveyor.

The south side is further marked:

NEW JERSEY:
ABRAM BROWNING,
THOMAS N. McCARTER,
GEORGE H. COOK,
Commissioners.
E. A. BOWSER,
Surveyor.

This monument stands on the property of the Palisade Land Company, and aside from having three of its corners chipped, it is in excellent condition.

MONUMENT No. 1, ON ROAD BETWEEN THE EASTERN WITNESS OR REFERENCE MONUMENT AND MILESTONE "1."

This monument is situated on the west side of the boulevard which leads from Alpine, New Jersey, to the village of Palisades, New York. It is at the east foot of the hill which rises about 30 degrees to its summit, distant about 100 paces, and is also 2,728 feet east of milestone "1." At the monument the following bearing was taken: South, 51 degrees, east 5 feet to a white wood tree. Soil sandy. Disc set in lime.* This monument has its southeast and northeast corners slightly chipped, otherwise was found to be in good condition.

MONUMENT No. 2 OR MILESTONE No. "1."

This monument is situated on the slope of a ridge between the boulevard and the road from Alpine to Palisades. It is about 971 feet east of monument No. 3, and stands on land belonging to Jacob S. Moore, and 25 paces north of a fence running up over the ridge. At the monument the following bearings were taken: South 85 degrees, west 18 paces to a large oak, and south 72 degrees, west 14 paces to another. Soil sandy. Disc set in leaves. This monument has its north corners slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 3 OR ROAD No. 1, BETWEEN MILESTONES "I" AND "II."

This monument is situated on the west side of the road which leads from Closter north to Palisades, and is about 971 feet west of milestone 1, and is on ground sloping eastward. At the monument the following bearing was taken: North 50 degrees, east 30

(*See note at close of Report on page 193.)

paces to a large oak which stands on the west side of the road about 100 feet south of David Manson's house. Soil sandy for a depth of 3 feet, when solid rock was encountered. Disc set in wood ashes. This monument has its southeast corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 4 OR ROAD No. 2.

This monument is situated on the west side of a road leading from Closter to Sparkill, and is about 2,992 feet west of milestone 1, and on ground sloping westward. At the monument the following bearing was taken: North by west 5 feet to a shade maple. Soil sandy. Disc set in wood ashes. This monument leans very slightly to the north and has its corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 5 OR MILESTONE No. "II."

This monument is situated in the Tappan timber swamp, on the land of Jacob Blauveld, and is about 2,304 feet west of monument No. 4 and ten paces south of rail fence on ground which is low all around and at times covered with water. At the monument the following bearings were taken: South 51 degrees, east 6 paces to a stump of a hickory standing on " line;" also north 75 degrees, east 3 paces to a large oak. Soil clayey. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 6 OR ROAD No. 1. BETWEEN MILESTONES Nos. "II" and "III" OR NORTHERN RAILROAD OF NEW JERSEY.

This monument is level with the surface of the ballast of the road bed of the Northern Railroad of New Jersey, 2 feet 11 inches west of the westerly rail, and 104 feet 4 inches from the center (at the westerly end) of the center pier of the railroad bridge over small stream, Sparkill, it is also 1,501 feet west of milestone " II " 327 paces southeast of Tappan station. Disc is set in ashes from the railroad; the bottom and corners of the stone are badly chipped.

MONUMENT No. 7, OR ROAD No. 2.

This monument is situated on the west side of the road leading from Norwood to Tappan, just inside of wire fence, and is about 2,904 feet west of milestone " II " upon the edge of high ground bordering a little swamp and 130 paces north of highway bridge crossing Sparkill creek. At the monument the following bearing was taken: North 30 degrees, east 75 paces to the southwest corner of a barn which stands just east of the road. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 8 OR ROAD No. 3.

This monument is situated on the east side of the road leading from Schraalenburgh to Tappan, about 4,400 feet west of milestone " II " and on ground rising gently northwest. At the monument the following bearings were taken: North 76 paces to the southeast corner of the Dutch Methodist church, standing just east of the road; also about north 48 paces to the front entrance of Sansom's yard; also about 10 feet northerly to a cedar tree standing on the same side of the road. Soil sandy and somewhat stony. Disc set in wood ashes. This monument has its corners and edges chipped, otherwise it was found to be in good condition.

MONUMENT No. 9 OR ROAD No. 4 OR WEST SHORE RAILROAD.

This monument is situated between the two westerly tracks of the West Shore railroad, about at the east foot of the slope rising to Andre hill, and 45 paces south 20 degrees west of Andre avenue. At the monument the following bearing was taken: North 50 degrees, west 67 paces to monument No. 10. Soil sandy. Disc set in wood ashes. This monument has all four corners badly chipped, otherwise it was found to be in good condition.

MONUMENT No. 10 OR ROAD No. 5 OR ANDRE AVENUE.

This monument is situated on the east side of Andre avenue, in front of land of James Bartow. It is about 5,051 feet west of milestone "II" and is 13 paces south of the westerly fence of the avenue and on the east slope of the hill. At the monument the following bearing was taken: North 10 degrees, west 30 paces to the middle house of three, which stands just north of the road or avenue. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 11 OR MILESTONE "III."

This monument is situated on the east slope of Andre hill, about 584 feet from the summit, or about half way up. At the monument the following bearings were taken: South 40 degrees, east 36 paces to the southwest corner of a little white house and south 70 degrees, west 18 paces to an old well. Soil of fine gravel and somewhat wet. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 12 OR ROAD No. 1 BETWEEN MILESTONES "III" AND "IV."

This monument is situated on the top of Andre hill, about 584 feet west of milestone "III" on land of Bartow. At the monument the following bearing was taken: South 9 paces to the northwest corner of Bartow's house. Soil sandy. Disc set in wood ashes. This monument has all four corners lightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 13 OR ROAD No. 2.

This monument is situated on the north side of the road, leading from Tappan to Rivervale, about 1,825 feet west of milestone "III," and on ground comparatively level. It is 24 paces northwesterly of a small bridge which is the beginning point of two road districts, and 20 paces easterly of the entrance into Andrew Harring's barnyard. At the monument the following bearing was taken: North 51 degrees, west to front door of Harring's house. Soil sandy. Disc set in cinders. This monument was found to be in good condition.

MONUMENT No. 14 OR MILESTONE "IV."

This monument is situated in an old plowed field once an old apple orchard belonging to Chas. Smith of Tappan. At the monument the following bearings were taken: North 10 degrees, west 22 paces to a white-wood tree and North 20° East 2′ 9″ to cedar tree. Soil sandy. Disc set in sand and monument in cement. This monument is 18 paces east from fence, and was found to be in good condition.

MONUMENT No. 15 OR ROAD No. 1, BETWEEN MILESTONES "IV" AND "V."

This monument is situated on the east side of the road leading from Rivervale to Orangeburgh, and running about north and south, is about 2,419 feet west of milestone "IV," 8 paces west of fence on east side of road and 11 paces south of a small bridge and on level ground. At the monument the following bearing was taken: North 10 degrees, east 111 paces to an old stone house owned by Samuel Harring. Soil somewhat gravelly. Disc set in light-colored sand. This monument was found to be in good condition.

MONUMENT No. 16 OR MILESTONE "V."

This monument is situated in the woods, about 50 paces west of a cleared lot, and about half way up the slope of a slight rise; it is also 5,261.27 feet west of milestone "IV," 20 paces west of an old wood road running north and south, and 140 paces south of the junction of this road and road across meadow, leading westerly from house formerly occupied by James Cassidy and now owned by Mr. Hawk. At the monument the following bearing was taken: South 5 degrees, east 4 feet to an oak tree 12″ diameter. Soil sandy. Disc set in leaves. This monument had one corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 17 OR ROAD No. 1, BETWEEN MILESTONES "V" AND "VI."

This monument is situated on the west side of a road running northeasterly and southwesterly, and leading to Blue Hill. It is also about 4,298 feet west of milestone "V," 68 paces south of the bridge and at the foot of a slight northerly slope. At the monument the following bearing was taken: North 80 degrees, east 138 paces to a large locust tree standing in Mr. Priest's front yard. Soil sandy and slightly gravelly. Disc set in wood ashes. This monument has its northeast and southwest corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 18 OR MILESTONE "VI."

This monument is situated on the east slope of the hill in the wood lot belonging to Mr. Priest and is 5,225.18 feet west of milestone "V." At the monument the following bearings were taken: South 51 degrees east, 9 feet to a 12-inch elm tree, and north 42 degrees, east 11 paces to a hickory tree. Soil sandy. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 19 OR ROAD No. 1, BETWEEN MILESTONES "VI" AND "VII."

This monument is situated on the west side of a road running south 75 degrees east, and north 75 degrees west and is about 3,408 feet west of milestone "VI," and 13 paces north of an 18-inch ash tree on the roadside. At the monument the following bearings were taken: South 70 degrees, east 12 paces to a maple which stands between the east edge of the road and the stone fence; also, north 30 degrees, east 55 paces to a thorny locust tree which stands in the front yard of W. Comes. Soil sandy. Disc set in wood ashes. This monument has its northeast corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 20 OR MILESTONE "VII."

This monument is situated very near the summit of the first ridge west of the road in an orchard on the land of Jacob Horn and is about 5,241 feet west of milestone "VI" and 1,833 feet west of monument No. 19; also, 13 paces from the westerly fence of the orchard. At the monument the following bearings were taken: North 65 paces to a large chestnut tree standing in the extreme northeast corner of the woods, the line also crosses the fence between the orchard and the woods at a distance of 130 paces northerly along the same from the lane. Soil sandy. Disc set in sand and monument in cement. This monument was found to be in good condition.

MONUMENT No. 21 OR ROAD No. 1 BETWEEN MILESTONES "VII" AND "VIII," OR THE NEW JERSEY AND NEW YORK RAILROAD.

This monument is situated on the west side of the track of the New Jersey and New York railroad one foot from the end of the ties and about 1,640 feet west of milestone "VII" and about 880 paces along the track from the southeast corner of the depot at Pearl river, and in a slight cut. This monument has its corners badly chipped.

MONUMENT No. 22 OR ROAD No. 2.

This monument is situated on the west side of a road leading from Mount Vale to Pearl river and running about north and south, at the east foot of the hill, about 2,063 feet west of milestone "VII" and 385 feet west of monument No. 21; also, about 12 feet north of the corner of a line fence running about north 51 degrees west over the hill. At the monument the following bearing was taken: South 45 degrees, east 13 paces to the northwest corner of Buttock's barn. Soil sandy. Disc set in wood ashes. This monument has its east corners slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 23 OR MILESTONE No. "VIII."

This monument is situated in an open field belonging to Harry G. Hollis on slightly rolling ground, it is about 5,251.25 feet west of milestone "VII" and about 250 paces west of the nearest point of the Pascack creek. At the monument the following bearings were taken: South 70 degrees, west 15 paces to an apple tree and south 15 degrees, east 90 paces to a chestnut tree standing in the corner of the field. Soil sandy. Disc set in sand and the monument in cement. This monument was found to be in good condition.

MONUMENT No. 24 OR ROAD No. 1 BETWEEN MILESTONES "VIII" AND "IX."

This monument is situated on the east side of the road, which runs north and south, and is about 449 feeet west of milestone "VIII" and about 10 feet north of a small stream on ground sloping eastward. At the monument the following bearing was taken: South 24 paces to the northwest corner of a house standing just east of the road. Soil very gravelly and the hole full of water. Disc set in wood ashes. This monument has heaved 4 inches; otherwise it was found to be in good condition.

MONUMENT No. 25 OR ROAD No. 2.

This monument is situated on the north side of the road, running nearly east and west, just at the top of a hill, about 2,320 feet west of milestone "VIII" and about nine paces west of rail fence running northerly. At the monument the following bearings were taken: South 50 degrees, east 12 paces to a birch tree, and south 9 paces to a chestnut tree standing on opposite side of road and near the bars. Soil sandy. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 26 OR ROAD No. 3.

This monument is situated on the west side of the road, about 3,492 feet west of milestone "VIII" and about opposite the point at which a road running north and south enters the main road on which the monument is set. The main road runs from Nanuet to Saddle river and across road to Pearl river. At the monument the following bearings were taken: South 50 degrees, east 22 paces to a small white oak standing just inside of the fence and at the intersection of the roads, and north 51 degrees, west about

500 feet to the house at the top of the hill. Soil somewhat gravelly and much water in the hole. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 27 OR ROAD No. 4.

This monument is situated on the west side of the road, which runs about north and south, leading from Hackensack to Spring Valley, and is about 109.51 feet east from milestone "IX" and on level ground, 100 paces from Daniel A. Post's house. At the monument the following bearings were taken: 18 degrees, east 70 paces to a butternut tree which stands just in the angle of the fence, and north 18 degrees, east 93 paces to the southeast corner of an old building belonging to Mr. Post and standing just west of the road. Soil sandy. Disc set in wood ashes. This monument has heaved 5 inches, otherwise it was found to be in good condition.

MONUMENT No. 28 OR MILESTONE No. "IX."

This monument is situated in an open field on the property of Mr. Post and on level ground. At the monument the following bearings were taken: North 51 degrees west 115 paces to Post's house, and northeast 65 paces to the butternut tree described in the preceeding description. Soil sandy. Disc set in sand and monument in cement. This monument was found to be in good condition.

MONUMENT No.29 OR ROAD No. 1 BETWEEN MILESTONES "IX" AND "X."

This monument is situated on the west side of the road running about north and south, and is about 318 feet east of milestone "X" and on level ground. At the monument the following bearings were taken: South 20 degrees, west 55 paces to the northeast corner of Leadwith's house, and north 32 degrees, east 80 paces to the northeast corner of John A. Christopher's house. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 30 OR MILESTONE No. "X."

This monument is situated in an open field on the property of Mr. Leadwith, and just a little on the westerly slope of a slight rise, and is about 5,286.6 feet west of milestone " IX." At the monument the following bearings were taken: South 26 degrees, east 135 paces to the northwest corner of Leadwith's house and south 78 degrees, west 92 paces to a chestnut tree. Soil sandy. Disc set in sand and monument in cement. This mounment was found to be in good condition.

MONUMENT No. 31 OR ROAD BETWEEN MILESTONES "X" AND "XI."

This monument is situated on the east side of the road leading from Saddle river and running south 20 degrees west and north 20 degrees east. It is about 4,050 feet west of milestone "X" and on ground sloping gently westward to Saddle river, distant about 270 paces under barbed wire fence. At the monument the following bearings were taken: North 55 degrees, west across the road 16 paces to an apple tree standing just inside of the fence, and north 11 degrees, west 37 paces to the southeast corner of Michael Connely's barn. Soil gravelly and sandy and hole very wet. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 32 OR MILESTONE No. "XI."

This monument is situated in a little cedar grove belonging to Van Buskirk, and is 5,267.6 feet west of milestone "X" and about 1,217 feet west of monument No. 31, on ground ascending westward, 15 paces from the stone and rail fence separating young apple orchard from cedar grove and 45 paces easterly from a small shed. Soil sandy and somewhat stony. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 33 OR ROAD No. 1 BETWEEN MILESTONES "XI" AND "XII."

This monument is situated on the east side of the road which runs north 75 degrees west and south 75 degrees east; it is about 2,258 feet west of milestone "XI" and on the west slope of a hill near the top. At the monument the following bearings were taken: North 75 degrees, west 20 feet to a large chestnut tree standing just north of the road, and south 84 degrees, east 32 paces to the southwest corner of John McMahon's house, which stands north of the road and about at the top of the hill. Soil sandy. Disc set in wood ashes. This mounment was found to be in good condition.

MONUMENT No. 34 OR ROAD No. 2.

This monument is situated on the east side of a road which runs northeast and southwest, and is 3,585 feet west of milestone "XI" and about at the foot of the hill adjoining lands of Margaret DeBarry. At the mounment the following bearings were taken: South 52 degrees, west 40 paces to an apple tree, and north 25 degrees, east to a buttonwood tree which stands near a bridge, and on the east bank of a stream, also 5 paces to the nearest point on said stream, and 20 paces south along the road to a point where it makes a right angle and runs eastward up the hill. Soil sandy. Disc set in wood ashes. This monument was chipped on south edge, otherwise it was found to be in good condition.

MONUMENT No. 35 OR ROAD No. 3.

This mounment is situated on the west side of the River Valley road, which runs about north and south, and is about 4,083 feet west of milestone "XI" and on the east slope of a hill. At the monument the following bearing was taken: South 10 degrees, east 31 paces along the road to a barn on the east side. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 36 OR MILESTONE No. "XII."

This monument is situated in a wood lot belonging to Cornelius Snyder at the west foot of the hill, about 25 paces north, 51 degrees west from the corner of the line fence which ends at the woods and 23 paces southwest of bars in fence running northerly. At the monument the following bearing was taken: North 16 paces to an oak tree standing near a fence running east and west. Soil sandy. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 37 OR ROAD No. 1 BETWEEN MILESTONES "XII" AND "XIII."

This mounment is situated at the top of a hill and on the east side of a road running north and south from Saddle river to Tallmans and is about 3,304 feet west of milestone "XII." At the monument the following bearings were taken: South 23 degrees, east 12 paces to the northeast corner of James Fox's house, and north 22 degrees, east 17 paces to an old apple tree. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 38 OR MILESTONE No. "XIII."

This mounment is situated on the west slope of a hill in a young peach orchard, the property of Louis H. Doremus, and north 50 paces to a small white oak standing in the northwest corner of the field. Soil sandy. Disc set in sand and monument in cement. This monument has its top almost flush with the ground, otherwise it was found to be in good condition.

MONUMENT No. 39 OR ROAD No. 1 BETWEEN MILESTONES "XIII"' AND "XIV."

This mounment is situated at the west foot of the hill and on the east side of a road running north 40 degrees, east and south 40 degrees west, and is about 673 feet west of milestone "XIII." At the monument the following bearings were taken: South 18 degrees, east 30 paces to the northwest corner of Doremus house and north 10 paces to a whitewood tree standing on the opposite side near a large boulder. Soil coarse gravel. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 40 OR ROAD No. 2.

This monument is situated at about the east foot of a hill and on the west side of a road which runs north 20 degrees east and south 20 degrees west, and is about 2,782 feet west of milestone "XIII." At the monument the following bearing was taken: North 20 degrees, east 90 paces to a corner of a line fence between W.

W. Way and P. W. Sutherland. Soil sandy. Disc set in wood ashes. This monument has heaved 4 inches, otherwise it was found to be in good condition.

MONUMENT No. 41 OR MILESTONE "XIV."

This monument is situated in the edge of the woods on the west slope of the hill and 5,298 feet west of milestone "XIII." At the mounment the following bearings were taken: South 42 degrees, east 9 paces to a white oak tree, and south 50 degrees, west 9 paces to a white oak tree; also about one-half mile west of W. W. Way's house, and at the corner of his land and David Fox's, Way's fence running westerly and Fox's running northerly. Soil sandy. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 42 OR ROAD No. 1 BETWEEN MILESTONES "XIV" and "XV."

This monument is situated on the south side of a private road or lane leading up to Colonel David Fox's house, and is 3,343 feet west of milestone "XIV" and on level ground outside of wire fence. At the monument the following bearings were taken: North 85 degrees, east 190 paces to a large oak tree standing just outside of the yard's limit, and south 85 degrees, west 5 paces to a shade maple tree. Soil sandy. Disc set in sand and monument being broken was set in cement. This monument was slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 43 OR ROAD No. 2.

This monument is situated on the east side of the old Ramapo post road, which runs about north and south, and is about 4,705 feet west of milestone "XIV." At the monument the following bearing was taken: South 215 paces to the bridge over the Mahwah river also about 1 pace south of the corner of David Fox's line fence. Soil sandy. Disc set in ashes from the railroad. This monument is slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 44 OR ROAD No. 3, OR THE NEW YORK, LAKE ERIE AND WESTERN RAILROAD.

This monument is situated between the two main tracks of the New York, Lake Erie and Western railroad, about 46 paces west of monument No. 43 and 4,839 feet west of milestone "XIV." The slag or stone ballast of the railroad covers this monument to a depth of about 1 foot. Soil a mixture. Disc set in ashes from the railroad. Aside from this monument being covered to the depth of about 1 foot with the ballast of the railroad, it was found to be in good condition.

MONUMENT No. 45 OR MILESTONE No. "XV."

This monument is situated in an open field upon the land of Dr. Zabriskie and is about 5, 280 feet west of milestone "XIV" on level ground, about 25 paces westerly of rail fence running northeasterly. At the monument the following bearings were taken: South 60 degrees, east 35 paces to an apple tree and north 50 degrees, east about 75 paces to Zabriskie's house Soil sandy. Disc set in sand and monument in cement. This monument was found to be in good condition.

MONUMENT No. 46 OR ROAD No. 1, BETWEEN MILESTONES "XV" AND "XVI."

This monument is situated on the east side of the road which runs north and south along the east foot of the Ramapo mountains, and is about (no distance given in original report) west of milestone "XV." At the monument the following bearing was taken: South 60 degrees, east 100 paces to the house of Owen DeGroot (colored), and north about 6 feet to a butternut tree standing opposite the end of a line fence. Soil sandy. Disc set in wood ashes. This monument has its southwest corner chipped down from the top a distance of about 10 inches and its other corners slightly chipped.

MONUMENT No. 47 OR MILESTONE No. "XVI."

This monument is situated about half way up the east slope of the Ramapo mountains and 10 feet east of a wood road which leaves the main road opposite the house of Owen DeGroot, about 10,463 feet west of milestone "XIV" and about 200 feet westerly on line from the cabin of Peter Mann. At the monument the following bearing was taken: North 65 degrees, east to the spire of the Episcopal church in Suffern. Soil sandy until about 6 inches of the full depth, when a rock ledge was encountered on which was cut a cross in place of the disc. This monument was found to be in good condition.

MONUMENT No. 48 OR MILESTONE No. "XVII."

This monument is situated on the east slope of a ridge and just on the southeast edge of a little clearing, and is 5,141.65 feet west of milestone "XVI." and 9 paces northwest of path. At the monument the following bearings were taken: North 65 degrees, west 250 paces to a chestnut tree standing in the dooryard just north of Abel Mann's house, and north 15 degrees, west 3 paces to a large white oak stump 6 feet high. Soil very rocky. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 49 OR MILESTONE No. "XVIII."

This monument is situated in an open field belonging to the Pierson estate, and about half way down a gradual slope which begins at the mountain, on the southeast, and slopes westward. It is 5,301.2 feet west of milestone "XVII." At the monument the following bearings were taken: North 85 degrees, east 9 paces to a maple, and north 18 degrees, west about 20 paces to an apple tree, also about 200 paces northerly to Mrs. Mann's house. Soil gravelly. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 50 OR ROAD No. 1, BETWEEN MILESTONES "XVIII" AND "XIX."

This monument is situated on the east side of a road running north 30 degrees east, and south 30 degrees west through the valley. The monument is about 10 paces north of a large bowlder, having blazed trees all about it. The bowlder is of the following dimensions: About 12 feet long, 6 feet high and 10 feet wide. Soil sandy. Disc set in leaves. This monument is 156 paces southwest along said road from center of bridge over small stream at 197 paces from big bowlder at forks of same road, and one that goes up the hill. This monument has heaved 6 inches, otherwise it was found to be in good condition.

MONUMENT No. 51 OR MILESTONE No. "XIX."

This monument is situated very near the top of the ridge between Negro and Shepherd ponds in the woods on land belonging to Charles Morris. At the monument the following bearings were taken: North 75 degrees, west 3 feet to a small white oak, and north 75 degrees, east 3 paces to a hickory. The house which stands on the northwest corner of Shepherd pond bears north 50 degrees west. Soil sandy until about 6 inches of the required depth, where a ledge of rock was encountered on which a mark was cut in place of the disc. This monument was found to be in good condition.

MONUMENT No. 52 OR ROAD No. 1, BETWEEN MILESTONES "XIX" AND "XX."

This monument is situated in the woods about 60 paces west of milestone "XIX," and a little on the west slope of the ridge, and on the east side of the road which runs north, east and south. At the monument the following bearings were taken: East 2 paces to a clump of three chestnut trees and S. W. along road to the middle of 3 boulders. Soil fine sand. Disc set in leaves. This monument has 3 corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 53 OR ROAD No. 2.

This monument is situated at the top of the first hill west of Shepherd pond and on the east side of the road, now but little used, running north 20 degrees east and south 20 degrees west, about 4,023 feet west of milestone "XI," and on south side of line worm fence and 220 paces along road southerly to a house. At the monument the following bearing was taken: North 51 degrees, west about 2 paces to a hickory stump about 5 inches in diameter, which was exactly on line. N. 750 E. 6 paces to a shell bark hickory. N. 10 degrees W 11 paces to another. Soil sandy. Disc set in wood ashes. This monument has its northeast corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 54, OR MILESTONE No. "XX" AND COUNTY STONE.

This monument is situated in a wet meadow, about 80 paces west of the edge of the woods which skirt the meadow and is 5,227.4 feet west of milestone "XIX" and in a line fence between the land of Abraham S. Hewitt and Colonel Payne. It marks the corner of the counties of Rockland and Orange, N. Y. At the monument the following bearing was taken: South 58 degrees, east 75 paces to a large oak which, about 7 feet from the ground, divides into two trunks. Soil about 2 feet turf, 2 feet blue clay, and the balance good solid sandy gravel; hole filled with water, but the monument is firmly set in cement and the disc put in as usual. This monument was heaved 4 inches, otherwise it was found to be in good condition.

MONUMENT No. 55, OR ROAD No. 1, BETWEEN MILESTONES "XX" AND "XXI."

This monument is situated in the valley on the west side of a road which runs north 45 degrees east, and south 45 degrees west, it is about 2,544 feet west of milestone "XX" and 5 paces north of a small brook. At the monument the following bearing was taken: North 65 degrees, east 60 paces to the southeast corner of a frame house. Soil gravelly and many bowlders; hole filled with water. Disc set in wood ashes. This monument has the east corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 56 OR MILESTONE No. "XXI."

This monument is situated on the west slope of a high ridge, and is just on the south edge of a small clearing and on the west edge of a wood road belonging to Abraham S. Hewitt. At the monument the following bearing was taken: South 51 degrees, east 4 paces to an 18-inch white ash tree standing on line. Soil sandy. Disc set in leaves. This monument was found to be in good condition.

MONUMENT No. 57 OR ROAD No. 1, BETWEEN MILESTONES "XXI" AND "XXII."

This monument is situated on the west slope of the mountain, and on the east side of a wood road leading from Ringwood to Sterling Furnace, which runs south 85 degrees east, and north 85 degrees west, and is about 100 paces west of milestone "XXI." At the monument the following bearings were taken: North 85 degrees, west 9 paces to a white oak tree standing on the west edge of the road, and N. 60 degrees E. 7 paces to a chestnut tree. Soil sandy. Monument was broken in getting it to the place, and in consequence was only set about 2 feet, but very firmly. This monument was found to be in good condition.

MONUMENT No. 58, OR MILESTONE No. "XXII."

This monument is situated in the woods on the southeast slope of a hill which appears to be a projection from the Black Rock mountain; it is 5,258.46 feet west of milestone "XXI" and just on the edge of a lot of large rocks. At the monument the following bearings were taken: North 53 degrees, west about 200 paces to the large boulder which caps the south end of Black Rock mountain, and south 48 degrees, east about 4 paces to a small rock oak, also south 32 degrees, east 16 paces to twin white oak 10 inches in diameter, which separates about 2 feet above ground, about 33 paces easterly along foot of ledge is the blazed line painted red showing the boundary of the Hewitt property, which line has no connection with the State line. Very rocky all about, and in consequence a mark was cut in place of disc. This monument was found to be in good condition.

MONUMENT No. 59 OR ROAD No. 1 BETWEEN MILESTONES "XXII" AND "XXIII."

This monument is situated in the valley between Black Rock and Beach mountains; it is about 4,012 feet west of milestone "XXII" and on the east side of a road which runs south 80 degrees west and north 80 degrees east. At the monument the following bearing was taken: North 72 degrees, west 30 paces to a whitewood tree and an elm stump which stand on the edge of a swamp; also about 14 paces to a small stone culvert marked No. 349. Solid rock was encountered and no disc was used. This monument was found to be in good condition.

MONUMENT No. 60 OR MILESTONE No. "XXIII."

This monument is situated in a swamp, but on ground somewhat higher, about the foot of Beach mountain, in thick, young woods. At the monument the following bearings were taken: South 20 degrees, west about 1,000 feet to the house of Mr. Patterson, on Beach farm, and south 24 degrees, east 25 paces to an oak which stands on the southwest corner of a small clearing where now stands the ruins of an old house; it is 4,586 feet west of milestone "XXII" and at the foot of two birch trees. Soil sandy. Disc set in leaves. This monument was found to be in good condition, and surrounded by a pile of field stones 4 feet in diameter.

MONUMENT No. 61 OR MILESTONE No. "XXIV."

This monument is situated on the west slope of Beach mountain, about half way down, and on the west side of a road running about north and south, which at this point runs down hill toward the north; it is also 5,197 feet west of milestone "XXIII." At the monument the following bearing was taken: South 67 degrees, west 40 paces to a large chestnut tree which stands just on the east edge of a wood road which leaves the main road near the monument, also 3 paces E. of monument on side of road are 2 small boulders and N. along road 130 paces to a small brook which is dry in summer. Soil sandy. Disc set in leaves. This monument was found to be in good condition.

MONUMENT No. 62 OR MILESTONE No. XXV."

This monument is situated on the west slope of the first ridge east of Greenwood lake and in the northwest corner of a swamp; it is also 5,247.4 feet west of milestone "XXIV." At the monument the following bearings were taken: North 55 degrees, east 5 paces to an oak, and south 48 degrees, east 60 paces to a pepperage tree 18 inches in diameter; also about south 75 degrees east to a ledge of rock about 40 feet high and 130 paces distant. Soil clay and somewhat wet. No disc used. This monument was found to be in good condition.

MONUMENT No. 63 OR ROAD No. 1, OR THE NEW YORK AND GREENWOOD LAKE RAILWAY.

This monument is situated at the west foot of the ridge on the east side of the New York and Greenwood Lake railroad track, and is about 2,525 feet west of milestone "XXV" and 15 paces east of the edge of Greenwood lake. At the monument the following bearings were taken: North 40 degrees, east about 21 paces to the southeast corner of Chas. Cooper's house, and south 40 degrees, west 32 paces to the northeast corner of the railroad station. Soil sandy. Disc set in ashes from the railroad. This monument leans slightly to the north and has all corners slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 64 OR MINESTONE No. "XXVI."

This monument is situated at the east foot of Rough mountain 5,282 feet west of milestone "XXV" and southeast 16 paces from the southeast corner of the Hohokus clubhouse. At the monument the following bearings were taken: North 23 degrees, west 65 paces to a large sugar maple tree which stands 10 paces west of the road, and south 70 degrees, west 50 paces to another tree which stands 10 paces east of the road. Soil gravelly. Disc set in sand. This monument has heaved and tipped to the N. W. and has the south corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 65 OR ROAD No. 1, BETWEEN MILESTONES "XXVI" AND "XXVII."

This monument is situated on the west side of the road which runs north 20 degrees east and south 20 degrees west along the east foot of Rough mountain, and is about 50 paces west of milestone "XXVI." At the monument the following bearings were taken: North 12 degrees, east 50 paces to a sugar maple tree, and south 5 degrees, west 59 paces to another tree (both of which are mentioned in the preceding description), also 760 paces along the road to the Lake Side House. Soil quite slatey. Disc set in charcoal. This monument has all corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 66 OR MILESTONE No. "XX."

This monument is situated on Rough mountain about 300 paces west of the last or highest ridge, and on the west edge of a bad swamp, and is distant 5,047.7 feet west of milestone "XXVI."

At the monument the following bearings were taken: South 50 paces to a pine tree, and east about 100 feet to the outlet of the swamp, also one pace southerly to a pine tree. At the outlet of the swamp the water runs westerly over a ledge of rocks which trend southerly, and on top of this ledge the monument is situated. Soil sandy, though apparently rocky everywhere else; cross cut on the ledge in place of disc. This monument was found to be in good condition.

MONUMENT No. 67 OR MILESTONE No. "XXVIII."

This monument is situated about half way up the easterly slope of a steep hill in thick young woods, 10 feet north of an old line fence and 100 paces north of a cleared field, and distant 5,161 feet west of milestone "XXVII." At the monument the following bearings were taken: South 5 degrees, east 5 paces to a small hickory standing in the line fence, and south 40 degrees, west to an old cellar to house standing on the north side of the lane which leads up by Dr. Holley's house. This monument was found to be in good condition.

MONUMENT No. 68 OR ROAD No. 1, BETWEEN MILESTONES "XXVIII" AND "XXIX."

This monument is situated on the west side of a road which runs north 20 degrees east and south 20 degrees west, along the west slope of the ridge, and is distant 1,295 feet west of milestone "XXVIII." At the monument the following bearings were taken: North 20 degrees, east about 90 feet to a large chestnut standing in the stone fence, and north 20 degrees, east about 110 feet to another, also 200 paces southely along the road to the lane leading to Dr. Holley's house. Soil gravelly and some slate. Disc set in sand. This monument is chipped along its southerly edge and has 3 corners broken, otherwise it was found to be in good condition.

MONUMENT No. 69 OR MILESTONE No. "XXIX."

This monument is situated about half way down the westerly slope of a steep hill in an open field of land of Mr. Wright, and is distant 5,232.8 feet west of milestone "XXVIII." At the monument the following bearings were taken: South 50 degrees, west 50 paces to a large buttonwood tree, and north 19 degrees, west 400 paces to the southeast corner of Wright's house. Soil sandy. Disc set in sand, and monument in cement. This monument was found to be in good condition.

MONUMENT No. 70 OR ROAD No. 1, BETWEEN MILESTONES "XXIX" AND "XXX."

This monument is situated on the west side of a road which runs north 40 degrees east and south 40 degrees west and is distant about 1,813 feet west of milestone "XXIX" and about at the west foot of the slope. At the monument the following bearings were taken: North 50 degrees, east 240 paces to a small house standing opposite the junction of the roads and south 40 degrees, west 100 paces to the northeast corner of tenant house of Erastus Horton, also about 40 paces southerly along the road to a bridge. Soil sandy. Disc set in wood ashes. This monument has heaved 6 inches and has east corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 71, OR MILESTONE No. "XXX."

This monument is situated on the top of a mountain and on the east slope of a ridge, about 30 paces west of an old wood road which runs between this ridge and one a little farther west, 5,325 feet west of milestone " XXIX " and 40 paces west of the west end of worm line fence. At the monument the following bearings were taken: North 51 degrees, west 7 paces to a large oak stump, and southerly 4 feet to a small hickory stump 6 inches in diameter, 5 feet long, standing alone. Soil sandy. Disc set in leaves. This monument was found to be in good condition.

MONUMENT No. 72 OR ROAD No. 1, BETWEEN MILESTONES "XXX" AND "XXXI."

This monument is situated 25 feet east of the east side of a road which runs north 40 degrees east and south 40 degrees west through the hollow; it is distant about 1,020 feet west of milestone "XXX" and 5 paces easterly of the point where the brook crosses the road through a stone culvert and at the west foot of the hill. At the monument the following bearings were taken: North 68 degrees, west 20 paces to a large hemlock tree, and south 65 degrees, east 13 paces to a chestnut tree, also 3 paces to a black oak tree. Soil sandy but very stiff and hard towards the bottom. No disc used. This monument was found to be in good condition.

MONUMENT No. 73 OR ROAD No. 2.

This monument is situated on the east side of a road running about north and south, and about at the top of a hill, and is distant 2,260 feet west of milestone "XXX." At the monument the following bearings were taken: North 8 degrees, west 83 paces to a large hickory tree which stands just on the roadside in front of the residence of John W. House, and north 58 degrees, west 22 paces to an apple tree standing in the orchard west of the road. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 74 OR MILESTONE No. "XXXI."

This monument is situated in an open field on the land of Millard Wallace, and on the gentle west slope of the hill, 5,280 feet west of milestone "XX" and 27 paces west of stone fence standing on west side of lane leading past Wallace's barn. At the monument the following bearings were taken: North 44 degrees, east 165 paces to the southeast corner of Wallace's barn. Soil sandy. Disc set in sand and monument in cement. This monument was found to be in good condition.

MONUMENT No. 75 OR ROAD No. 1, BETWEEN MILESTONES "XXXI" AND "XXXII."

This monument is situated on the west side of a road running about north and south and sloping towards the north, and is distant 8,629.8 feet west of milestone "XXX." At the monument the following bearings were taken: North 7 degrees, east 425 paces along the road to the house of Levi Belden, which stands at the junction of the road, and north 76 degrees, west 8 feet to a pear tree standing just inside of the stone wall. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 76 OR ROAD No. 2.

This monument is situated on the west side of a road running north 78 degrees west and south 78 degrees east, and in front of and near the northeast corner of a picket fence and between two shade trees, 6 feet 9 inches south of one and 19 feet 9 inches north of the other. At the monument the following bearings were taken: North 33 degrees, west 82 paces to the northeast corner of Mr. Welling's house and south 88 degrees east to another house near the intersection of the road. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 77 OR MILESTONE No. "XXXII."

This monument is situated in an open field belonging to Mr. William R. Welling, about 3 paces east of a lane running from his house down across the Wawayanda, and is distant 5,317 feet west of milestone "XXXI." At the monument the following bearings were taken: South 34 degrees, east about 75 paces to the northwest corner of the main barn, and north 85 degrees, west 110 paces to a large hickory tree which stands in the southeast corner of a field and just opposite an angle in the lane; also south 80 degrees, east 40 paces to a large hickory tree distant 9 paces from the lane. Soil sandy. Disc set in sand and monument in cement. This monument has its northwest corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 78 OR ROAD No. 1, BETWEEN MILESTONES "XXXII" AND "XXXIII" ON LEHIGH AND HUDSON RIVER RAILROAD.

This monument is situated on the west side of the track of the Lehigh and Hudson River Railroad, and is distant about 2,367 feet west of milestone "XXXII." At the monument the following bearings were taken: South 88 degrees, east 100 paces to an elm tree which stands in the field about 100 paces south of the track and about 64 degrees, east 100 paces to a hickory tree, and south 23 degrees east to an elm tree, and also about 17 feet southerly along the railroad to the northerly abutment of the cattle pass. Soil sandy. Disc set in ashes from the railroad. This monument has two of its corners slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 79 OR ROAD No. 2.

This monument is situated on the east side of a road running north 70 degrees east, and south 70 degrees west on ground comparatively level, and is distant about 4,060 feet west of milestone "XXXII." At the monument the following bearings were taken: South 65 degrees, west 363 paces along the road southerly to the northeast corner of Alfred Ely's house, and north 35 degrees, west 25 paces to a butternut tree, a jog in the road fence is made at this point, also 263 paces along the road to where a brook crosses just at the junction of the road. Soil slatey. Disc set in wood ashes. This monument has the corners slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 80 OR ROAD No. 3.

This monument is situated on the west side of a road which runs north 25 degrees east, and south 25 degrees west, and at the east foot of a hill, and is distant about 4,616 feet west of milestone "XXXII." At the monument the following bearings were taken: North 51 degrees, west 4 feet to a large live oak tree, and north 60 degrees, east 65 paces to an elm tree, and east 25 paces to a butternut tree: Also 350 paces along the road southerly to Ely's house. Soil sandy with slate rock bottom. Disc set in wood ashes. This monument has its southwest corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 81 OR MILESTONE No. "XXXIII."

This monument is situated on the east slope of a ridge at the edge of the woods and just a little on the south side of a line fence on the property of A. Ely, and at the top of a stone ledge and is distant 5,355 feet west of milestone "XXXII." At the monument the following bearings were taken: North 51 degrees, west 5 paces to a large white oak tree on line, and south 51 degrees east 10 paces to a butternut tree on line, also south about 300 paces to Ely's house. Monument set in rock excavation, with cross cut on the bottom in place of disc. This monument was found to be in good condition.

MONUMENT No. 82 OR ROAD No. 1, BETWEEN MILESTONES "XXXIII" AND "XXXIV."

This monument is situated on the west side of a road running, north 50 degrees east, and south 50 degrees west on the west slope of a hill, about 4,354 feet west of milestone "XXXIII." At the monument the following bearings were taken: South 40 degrees, west 150 paces to the house of Mr. Forsher, and also about 3 feet to the corner of a line fence. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 83 OR MILESTONE No. "XXXIV."

This monument is situated in an open swampy field 200 feet west of west end of line fence on land of Mr. Layton, 5,280 feet west of milestone "XXXIII" and east of Pochuck meadow. At the monument the following bearings were taken South 5 degrees, west 250 paces to the northwest corner of Layton's house, andnorth 51 degrees, west 95 paces to a buttonwood tree standing on line. Disc set in fine gravel. This monument projects about 12 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 84 OR MILESTONE No. XXXV."

This monument is situated in an open field on swampy low land about 100 paces east of the edge of the upland and the west edge of Pochuck meadow, 10 feet north of line fence, on the property of Linn Roy, and 5,351.5 feet west of milestone "XXXIV." At the monument the following bearings were taken: North 10 degrees, west to Mr. Roy's house, and south 10 degrees, east 6 paces to a pin oak tree standing on the south bank of a line brook. This tree is not notched or blazed. Soil soft and mushy. Disc set in sand and monument in cement. This monument projects about 14 inches above the ground and has its southeast corner clipped, otherwise it was found to be in good condition.

MONUMENT No. 85 OR ROAD No. 1, BETWEEN MILESTONES "XXXV" AND "XXXVI."

This monument is situated on the east side of a road running about at right angles to the line and on east slope of the Pochuck mountain, about 9 feet nort of line fence and 700 feet west of milestone "XXX." At the monument the following bearings were taken: South 50 degrees, east 50 paces to an elm tree standing in the fence, and south 24 degrees, west 70 paces to another on the east edge of the road. Soil sandy. Disc set in sand. This monument was found to be in good condition.

MONUMENT No. 86 OR MILESTONE No. "XXXVI."

This monument is situated in an open field on the east slope of the Pochuck mountain, and on the property of the Bush estate. and is distant 5,270 feet west of milestone "XXXV." At the monument the following bearings were taken: North 49 degrees, east 40 paces to the southeast corner of the log house of Thomas J. Ryerson, and south 64 degrees, east 50 paces to a large willow tree, also about south 55 degrees, east to a black walnut tree and east 20 paces to the railroad. Soil sandy. Disc set in wood ashes. This monument projects 9 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 87 OR MILESTONE No. "XXXVII."

This monument is situated in a ravine between two peaks of the Pochuck mountain, and on the west slope of the ridge, just on the north edge of a swamp, on lands of Drake and Stratton, and is distant 5,147.7 feet west of milestone "XXXVI." At the monument the following bearings were taken: South 51 degrees, east 25 feet to a live oak tree about 6 inches in diameter, and north 76 degrees, west 5 paces to another standing about 30 feet south of the road leading to the orchard; following this road easterly about 100 paces it opens into an apple orchard. Soil sandy. Disc set in leaves. This monument projects about 9 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 88 OR ROAD No. 1 BETWEEN MILESTONES "XXXVII" AND "XXXVIII."

This monument is situated on the westerly side of the road which runs north 43 degrees east and south 43 degrees west, and about at the west foot of the Pochuck mountain, and is distant about 3,651 feet west of milestone "XXXVII." At this monument the following bearings were taken: North 8 degrees, east 7 paces to a cherry tree standing just inside the fence, and south 46 degrees, west 200 paces to the northeast corner of Levine Potter's house. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 89 OR MILESTONE No. "XXXVIII."

This monument is situated in the meadow land east of the Wallkill river, north side of line fence, and 5,247.7 feet west of milestone "XXXVII." At the monument the following bearings were taken: North 16 degrees, west 63 paces to a maple tree standing on the west bank of a ditch, which begins at east of and runs at right angles to the willows which skirt the road running across the Wallkill, also north 85 degrees east to Yarrington's house which stands on Liberty corner. This monument is also in the line fence between the lands of Levine Potter and Drake & Stratton. Soil about 1 foot muck and the balance white sand. Disc set in sand and the monument in cement. This monument projects about 15 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 90 OR MILESTONE No. XXXIX."

This monument is situated on the east slope of and about 50 paces from the foot of the ridge west of the Wallkill lowlands, in a stone fence, and at junction of worm fence running southerly, and 3 feet south of small shanty on the line between the lands of Charles Tuttle and G. VanGelder, and is distant 5,278.7 feet west of milestone "XXXVIII." At the monument the following bearings were taken: South 70 degrees, east 48 paces to an oak tree standing in the edge of the lowlands, and north 55 degrees, west 5 paces to an oak stump standing just south of the fence. Disc set in wood ashes. This monument projects 12 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 91 OR ROAD No. 1, BETWEEN MILESTONES "XXXIX" AND "XL."

This monument is situated on the west side of the road which runs north 40 degrees east and south 40 degrees west, and about at the west foot of a steep hill, and is distant about 2, 100 feet west of milestone "XXXIX," and about 250 feet north of road running westerly. At the monument the following bearings were taken: North 40 degrees, east 425 paces along the road to Charles H. Tuttle's house, and north 30 degrees, west to Mr. Clark's house; also north 60 degrees, east 40 paces to a cherry tree. Soil sandy. Disc set in wood ashes. This monument has heaved 7 inches and has east corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 92 OR ROAD No. 2.

This monument is situated on the south side of a road which runs south 50 degrees east, and is about 100 paces along the same, west of the top, and is distant about 4,173 feet west of milestone "XXXIX." The road referred to follows the boundary on the southwest side thereof nearly to milestone "XL." At the monument the following bearings were taken: South thirty degrees, west about 250 paces to a house standing in a hollow, and north 51 degrees, west to a large line tree. Soil sandy. Disc set in wood ashes. This monument has west corner chipped, otherwise was found to be in good condition.

MONUMENT No. 93 OR MILESTONE No. "XL."

This monument is situated near the bottom of the west slope of the hill in an apple orchard, the land of Peter Kimber, and is distant 5,229.9 feet west of milestone "XXXIX," and 30 feet south of road. At the monument the following bearings were taken: North 78 degrees, west 58 paces to a butternut tree, and north 60 degrees, west 200 paces to Kimber's mill. Also about 100 paces to the intersection of the road. Disc set in sand and monument in cement. This monument was found to be in good condition.

MONUMENT No. 94 OR ROAD No. 1, BETWEEN MILESTONES "XL" AND "XLI."

This monument is situated on the north side of the road which runs nearly north and south, and about 100 paces east of the west foot of the hill, and is distant about 278 feet west of milestone "XL." At the monument the following bearings were taken: North 60 degrees, west 100 paces to the northeast corner of Kimber's mill, and south 5 degrees, east 70 feet to a butternut tree, also just opposite the intersection of the road. Soil sandy. Disc set in wood ashes. This monument leans slightly to the south, otherwise it was found to be in good condition.

MONUMENT No. 95, OR ROAD No. 2, OR THE NEW YORK, SUSQUEHANNA AND WESTERN RAILROAD.

This monument is situated at the west side of the track of the New York, Susquehanna and Western railroad, about 3 feet from the westerly rail, and just about at the north end of a slate cut, and 500 paces west of milestone "XL." At the monument the following bearings were taken: North 45 degrees, east 225 paces to the southeast corner of a barn which stands on the lower road just at the entrance to a lane and north 50 degrees, west 30 paces to an oak tree in stone fence. Disc set in wood ashes. This monument projects 16 inches above the ground and leans badly to the west, it has 2 corners chipped and should be reset.

MONUMENT No. 96 OR ROAD No. 3.

This monument is situated on the east side of a road running north 25 degrees east, and south 25 degrees west, and is distant 2,122 feet west of milestone "XL" and about 4 paces west of the west edge of a mill pond. At the monument the following bearings were taken: North 45 degrees, east 40 paces to the southwest corner of a sawmill and south 45 degrees, east 30 paces to a wild cherry tree standing just on the east bank of a pond, also about 20 paces southerly to the intersection of the road. Soil sandy for one foot, but very hard and stiff. Slate in the bottom. Disc put in the side and a mark cut on the rock. This monument leans slightly to the southeast, and has northeast corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 97 OR ROAD No. 4.

This monument is situated on the west side of a road which runs north 35 degrees, east, and south 35 degrees, west, and about at the west foot of a hill, and distant about 5,083 feet west of milestone "XL." At the monument the following bearings were taken: South 35 degrees, west 75 paces to a chestnut tree standing on the roadside at the top of the hill, also north 35 degrees, west 200 paces to Everett's barn. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 98, OR MILESTONE No. "XLI."

This monument is situated in an open field on the west slope of a small knoll near the foot of land of Aliakin Everett, and is distant 5,280 feet west of milestone "XL." At the monument the following bearings were taken: North 45 degrees, east about 200 paces to the southeast corner of Everett's barn and south 5 degrees, east 115 paces to a chestnut tree mentioned in the preceding description. Soil sandy. Disc set in sand and monument in cement. This monument projects only 3 inches above the ground, northwest corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 99, OR ROAD No. 1, BETWEEN MILESTONES Nos. "XLI" AND "XLII."

This monument is situated on the north side of a road which runs north 68 degrees, west, and south 68 degrees, east, and is distant about 418 feet west of milestone "XLI." At the monument the following bearing was taken: South 30 degrees, east 240 paces to a chestnut mentioned in No. 97. Soil sandy. Disc set in wood ashes. This monument has its corners chipped, otherwise it was found to be in good condition.

MONUMENT No. 100 OR ROAD No. 2.

This monument is situated on the east side of a road which runs north 25 degrees east and on the westerly slope of the hill, and is distant about 2,906 feet west of milestone "XLI." At the monument the following bearings were taken: South 30 degrees, east 14 paces to the southwest corner of R. E. Hallock's barn, and north 35 degrees, east 14 paces to a pear tree standing inside of a fence east of the road. Soil sandy. Disc set in wood ashes. This monument has its southeast corner chipped, otherwise it was found to be in good condition.

MONUMENT No. 101 OR ROAD No. 3.

This monument is situated on the west side of a road which runs north 10 degrees east and south 10 degrees west, and is at the east foot of a hill and just opposite or in the line with the line fence between the lands of S. W. Benjamin and Charles Goldsmith, and is distant about 4,624 feet west of milestone "XLI." At the monument the following bearings were taken: South 10 degrees west along the road to the northwest corner of Benjamin's house, and north 45 degrees, east 145 paces along the road to Goldsmith's barn, standing on the east side thereof. Soil sandy. Disc set in wood ashes. This monument leans slightly to the north, otherwise it was found to be in good condition.

MONUMENT No. 102 OR MILESTONE No. "XLII."

This monument is situated on the east slope of a hill, about 20 paces from the top on south side of line fence and at junction of fence running northerly between the lands of Benjamin and Goldsmith, and 5,261.95 feet west of milestone "XLI." At the monument the following bearings were taken: South 35 degrees, east about 300 paces to the northwest corner of Benjamin's house, also about 3 feet east to a live oak tree. Soil sandy, mixed with considerable slate. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 103 OR ROAD No. 1, BETWEEN MILESTONES "XLII" AND "XLIII."

This monument is situated at the west foot of a steep slope and on the west side of a road which runs north 50 degrees east and south 50 degrees west and opposite a line fence, and is distant about 1,250 feet west of milestone "XLII." At the monument the following bearings were taken: South 23 degrees, east 10 paces to an oak tree which stands very near a prominent ridge of rocks and north 30 degrees, east about 250 paces to the southeast corner of David P. Clark's house, also south 51 degrees, east 9 paces to a large crow-foot cut in the ledge of rock. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 104 OR MILESTONE No. "XLIII."

This monument is situated in a line fence between lands of Widow Clark and Hack in low meadow ground, and is distant

5,270 feet west of milestone "XLII." At the monument the following bearings were taken: North 32 degrees, west 57 paces to a sugar maple tree and north 15 degrees, west 422 paces to a little red house standing just east of the road and on the land of Clark northwest along fence 19 paces to twin maples. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition. It was rather difficult to find this monument standing as it does a trifle south of the center of a stone fence on line between lands of Clark and Hack.

MILESTONE No. 105 OR ROAD No. 1 BETWEEN MILESTONE "XLIII" AND "XLIV."

This monument is situated on the west side of a road which runs north 30 degrees east and south 30 degrees west, and is on the east slope of a small hill about 25 paces from the top, and is distant about 1,014 feet west of milestone "XLIII." At the monument the following bearings were taken: North 38 degrees, east 230 paces to the house mentioned in the preceding description, and south 51 degrees, east 9 paces to an oak tree which stands just on the east edge of the road, and is the corner between the townships of Greenville and Minnesink; also about 6 feet north of the corner of a line fence between the lands of Clark and Mr. Whorry. Soil sandy and very light. Disc set in wood ashes. This monument has its northwest corner broken, otherwise it was found to be in good condition.

MONUMENT No. 106 OR ROAD No. 2.

This monument is situated on the west side of a road which runs about north and south, on ground sloping gently westward, and is distant about 3,685.9 feet west of milestone "XLIII." At the monument the following bearings were taken: South 51 degrees, east to a corner of a line fence between land of Northrup and Clark, and north 55 degrees, west 300 paces to the northeast corner of Chris. Forgerson's house, which stands just south of a lane which leaves the main road 150 paces north of the monument; also north 47 degrees, east 60 paces to a white oak tree standing by the roadside. Soil very rocky towards the bottom. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 107 OR MILESTONE No. "XLIV."

This monument is situated in a kind of low swampy meadow on the north edge of a lane which runs by Forgersen's house, about 20 feet east of the edge of the upland and 45 paces west of a small stream, 5,304 feet west of milestone "XLIII." At the monument the following bearings were taken: South 51 degrees, east 5 paces to an oak tree, and north 51 degrees, west to a chestnut tree. Soil clay with some gravel. Disc set in wood ashes. This monument projects 14 inches above ground, otherwise it was found to be in good condition.

MONUMENT No. 108 OR ROAD No. 1, BETWEEN MILESTONES "XLIV" AND "XLV."

This monument is situated on the east side of a road which runs north 65 degrees east and south 65 degrees west, and on ground sloping gently eastward, and is distant about 2,965 feet west of milestone "XLIV." At the monument the following bearings were taken: South 20 degrees, west 100 paces to a large maple tree standing on the east bank of a brook, and about 2 paces to the corner of a line fence between the lands of John Taylor and the Widow Corwin; also south 58 degrees, west 190 paces to the northwest corner of the Widow Corwin's house. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 109 OR MILESTONE No. "XLV."

This monument is situated in the northeast corner of a meadow belonging to Albert Corwin, at the southwest corner of the woods, 3 paces westerly of worm fence running southerly, and is distant 5,301 feet west of milestone "XLIV." At the monument the following bearings were taken: North 55 degrees, west 450 paces to the northeast corner of Corwin's house, which stands on the west side of the road running along the east foot of Blue Mountain, and north 44 degrees, east 9 paces to a hickory tree. Soil clayey. Disc set in wood ashes. This monument projects 15 inches above the ground, otherwise it was found to be in good condition.

MONUMENT No. 110 OR ROAD No. 1, BETWEEN MILESTONES "XLV" AND "XLVI."

This monument is situated on the east side of a road which runs north 25 degrees east and south 25 degrees west along the east foot of the Blue mountains, and is distant 47 feet south of the corner of a line fence between the lands of Lansing Simpson and Albert Corwin. At the monument the following bearings were taken: South 55 degrees, west 34 paces to the northeast corner of the Widow Taylor's house, and north 25 degrees, east 200 paces to the southeast corner of Simpson's house. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 111 OR MILESTONE No. "XLVI."

This monument is situated in low scrub oaks on the west slope of the east summit of the Blue mountains, about 200 paces from the summit, and 210 paces west of an old wood road running north and south. At the monument the following bearings were taken: North 50 degrees, west 75 paces to a gum tree standing in the first hollow west of the summit, south 50 degrees, west to a pepperage tree, north 50 degrees, west 6 paces to a smaller pine tree, and north 50 paces to a hickory tree standing alone, southwest 3 paces to a rock oak and a scrub oak. Soil sandy. The monument having been broken in getting it to the place, was only set in about 1½ feet, but was very firmly wedged. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 112 OR MILESTONE No. "XLVII."

This monument is situated on the west slope of the Blue Mountains in a low thick brush, but on ground that has once been cultivated, and is distant 5,280 feet west of milestone "XLVI" and about 5 paces west of the edge of a wood road bearing south 65 degrees west. At the monument the following bearings were taken: South 45 degrees, west 15 paces to an oak tree which stands at the angle in the road and just on the north edge of a large growth of trees, also north 40 degrees, west about one-third of a mile to James Hamilton's house, which stands in Fiddler's Elbow. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 113 OR ROAD No. 1, BETWEEN MILESTONES "XLVII" AND "XLVII."

This monument is situated on the east side of a road which runs a little northeast and southwest and at the foot of Hogback mountain, and is distant about 10,000 feet west of milestone "XLVI." At the monument the following bearings were taken:

North 45 degrees west, to the south end of Alex. Burrow's house or saloon, which stands about 5 feet clear in New York, the line at this point passing between his house and saloon, also 3 feet south of the corner of a line fence between lands of Michael Fitzgerald and M. D. Graham. Soil sandy. Disc set in wood ashes. This monument has its top flush with the surface of the ground, otherwise it was found to be in good condition.

MONUMENT No. 114 OR MILESTONE No. "XLVIII."

This monument is situated on the top of the Hogback mountain on the south side of a line fence between lands of Thomas Dutton and the Widow Snyder, and is distant 10,419 feet west of milestone "XLVI," 40 feet east of a ridge of rock and 40 paces west of a small oak tree, about 5 inches in diameter, which stands in said line fence. At the monument the following bearings were taken: North 30 degrees, east 15 paces to a pine tree. No disc used. This monument has its northeasterly corner slightly chipped, otherwise it was found to be in good condition.

MONUMENT No. 115 OR ROAD No. 1, BETWEEN MILESTONE "XLVIII" AND CARPENTER'S POINT.

This monument is situated on the west side of a road which runs north 25 degrees east, and south 25 degrees west, on ground sloping gently eastward, and is distant about 300 paces west of milestone "XLVIII," in thick berry bushes. At the monument the following bearings were taken: South 64 degrees, west 125 paces to a hemlock tree standing on the top of the hill, and north 10 degrees, west 175 paces to the southeast corner of the Widow Snyder's house, also north 50 degrees, west to an old foundation.

Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

MONUMENT No. 116 OR NEVERSINK RIVER MONUMENT.

This monument is situated about 15 paces east of the water edge of the Neversink river and on land of Mr. Phillips. At the monument the following bearing was taken: South 50 degrees, east 135 paces to an old foundation standing south of the Widow Snyder's house. Soil sandy. Disc set in wood ashes. This monument was found to be in good condition.

WESTERN WITNESS OR REFERENCE MONUMENT.

This monument stands on an eminence about midway between the rivers Delaware and Neversink and on land of the Laurel Grove Cemetery Company, and is distant north 64 degrees, east 72½ feet from the tri-States rock or monument. It is similar in form and dimensions (above ground) to the witness or reference monument at the eastern terminus of the line, and in addition to the inscriptions cut on that monument, it is further marked on one of its faces with the words "Witness Monument" and on the north side with the words "The corner between New York and Pennsylvania is in the center of the Delaware river, 475 feet due west of the tri-State rock" and on the New Jersey side with the words "South 64 degrees, west 72½ feet from this is the tri-State rock, which is the northwest end of the New York and New Jersey boundary, and the north end of the New Jersey and Pennsylvania boundary." This monument was found to be in good condition.

TRI-STATE MONUMENT.

The point which this monument is intended to define was originally indicated by a crow foot cut in the natural limestone rock and which in 1874 was very plain, although its cut edges were somewhat smoothed by the exposure of 100 years. In 1874 the United States Coast and Geodetic Survey, at the request of the Geological Survey of New Jersey, determined accurately the latitdue and longitude of this point, and at the close of the work marked it by drilling a deep hole in the rock and fastening in it a copper tube filled with lead, and setting and describing proper witnesses of its location. The station point according to the determination is in latitude 41 degrees 21 minutes 22.63 seconds north; longtitude 74 degrees 41 minutes 40.70 seconds west from Greenwich.

By order of the joint commission on boundary line between the States of New York and New Jersey the copper bolt was excavated October 30, 1882, in making foundation for the existing granite monument, the center of which was placed directly over the point occupied by the bolt. The monument as originally set in 1882 was similar in form and dimensions and built into the solid rock in the same manner as the witness or reference monument at the eastern terminus of this line. In the Spring of 1883 the upper portion was broken off by ice, and on May 21, 1885, by order of Commissioner Leavenworth of New York, and Commissioner Cook, of New Jersey, the remaining portion was redressed to the existing dimensions, which are as follows: Two feet 4 inches long, 1 foot 4 inches wide, and 1 foot 5 inches high above the surface of the rock in which it is embedded. Upon its top surface it was marked with one-quarter inch groove showing the direction of the lines of the three States which meet there, and within the surface bounded by the lines the initials of the respective States are cut. The north side of the stone is further marked with the words "Tri-State Monument." This monument is built into the natural rock at the junction of and near the high water mark of the rivers Delaware and Neversink, and at this date is in good condition as above described.

NOTE.

The discs referred to in the above description are of earthen ware, 6 inches in diameter, 1 inch thick, and perforated in the center, and are, unless otherwise stated, placed vertically beneath the point to be marked by the monument, and 6 inches beneath its bottom, and are bedded in leaves, or wood ashes or some other distinctive material.

Respectfully submitted,

MERRITT PECKHAM, Jr.,

Engineer in charge.

New York and Massachusetts Boundary Line.

Historical Sketch Relating to the New York and Massasetts Boundary Line from Colonial Times to and including the Cession of Boston Corners.

King James I, granted by Letters Patent in 1620, November 3, to "The Council established at Plymouth in the County of Devon for the planting, ruling, ordering and governing of New England in America . . . all that part of America lying and being in breadth from fourty-eight degrees of said Northerly latitude from the equinoxtiall line, to fourty-eight degrees of said Northerly latitude, exclusively, and length of and within all the breadth aforesaid, throughout the maine lands, from sea to sea, together also with all firme lands, soyles, grounds, havens, ports, rivers, waters, fishing, mines and mineralls, as well royall mines of gould and silver as other mines and mineralls, precious stones, quarries and all and singular other commodities, jurisdiction, royalties, priveleges, franchises and preliminaries, both within the said tract of land upon the maine, and also within the islands and seas adjoining: Provided always that the said islands or any the premises hereinbefore mentioned, and by these presents intended and meant to be granted, be not actually possessed or inhabited by any other Christian Prince or State, nor within the Southern Colonies heretofore by us granted to be planted by divers of our loving subjects in the south part."

This proviso applied to the possessions of the Dutch along and near the Hudson river. In 1628, March 19, the Council conveyed to Sir Henry Roswell and his associates "all that parte of Newe England in America which lyeth and extendeth between a great

River there commonlie called Monomack alias Merrimack River, and a certain other River there, called Charles River, being in the Bottome of a certain Bay there commonlie called Massachusetts . . . and all lands and Hereditaments whatever lyeing within the lymits aforesaid, North and South in Latitude and Breadth, and in Latitude and Longitude, of and within all the Bredth aforesaid, throughout the Mayne Lands there from the Atlantic and Western Sea and Ocean on the East Parte to the South Sea on the West Parte."

A charter was granted in 1629, 4th March by Charles I, covering the same lands, with the proviso excepting lands actually possessed or inhabited by any other Christian Prince or State. The south bounds of this grant were afterwards found to be in latitude 42°02′ north, which is the latitude of the present north boundary of Connecticut.

In 1664 Charles Second granted to his brother James, Duke of York, certain lands in New England "together alsoe with the said River called Hudsons River and all the land from the west side of Connecticut River to the east side of De la Ware Bay." No boundary on the west was given although the presumption is that the western limit was the Deleware river. To remove all questions of doubt as to the validity of the Duke's title a second grant covering the same lands was made to him ten years latter.

The High Court of Chancery of England in 1684 ruled that the Massachusetts charter of 1629 given by Charles First was void. The validity of the deed given under this charter was apparently not affected by this ruling, although the New York Council in 1753 maintained that the charter under which the deed was given being void in itself would include the deed in its effects.*

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* N. Y. Council Minutes (MS.) xxiii, 55.

Upon the application of the agents of the colonists a new charter was granted October 7, 1691, incorporating the colonies of Massachusetts and New Plymouth, Maine and Nova Scotia into " one real province by the name of our province of the Massachusetts Bay in New England." This new province included " all that part of New England, in America, lying and extending from the great river commonly called Monomack, alias Merrimack, on the north part, and from three miles northward of the said river to the Atlantick or Western Sea or Ocean on the South part, and all the lands and hereditaments whatsoever, lying within the limits aforesaid, and extending as far as the outermost points or promintories of land called Cape-Cod, and Cape-Malabar north and south, and in latitude, breadth, and in length and longitude, of and within all the breath and compass aforesaid. throughout all the mainland there, from the said Atlantic or Western Sea and Ocean, on the east part, towards the South Sea, or westward, as far as our colonies of Rhode-Island, Connecticut, and the Narraganset country."

From this it is seen that the colony was limited toward the west by the western boundary of Connecticut. This boundary had been fixed by agreement November 30, 1664,* between Commissioners representing the Duke of York and delegates from the colony and was not " to extend into any part of the maine-Land further westward than the head of a Creeke or River at high water marke commonly called by the Indian name Mameronock and from thence by a direct line to the North North West till it meet with the Massachusetts line, nearer than the distance of Twenty Miles from any of the borders of the Maine River commonly called Hudsons River." . . . This agreement was ratified November 28, 1683, by Thomas Dongon, Governor of New York and by Robert Treat, Governor of Connecticut and the Commissioners of Connecticut.*

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* N. Y. Col. MSS., lxix, 4.

The first effort that was made to have the boundary line between the two provinces actually run was in a bill passed by the Massachusetts General Court November 19, 1719, calling for the appointment of "a Committee to join with such as the Governm't of New York shall appoint to run and settle the Divisional Line and Boundary between the s'd Provinces." In reply to this offer no action was taken by the New York Assembly, and nothing further was attempted in the matter until 1754, when on account of serious troubles that were occuring between the inhabitants of the two provinces in the vicinity of the disputed boundary some determined action became necessary. In that year a commission with stipulated powers, consisting of four members, was appointed by New York to act "in Conjunction with Commissioners on the part of the Province of Massachusetts Bay to settle, agree upon fix and ascertain the bounds between the said two provinces, or Provisional or Temporary Bounds between the said Governments to be deemed the Line of Jurisdiction and Limits until the true bounds shall be finally Settled."

A like commission was appointed by the Province of Massachusetts Bay, with its powers limited to the settling of a permanent line.

At the meeting of this joint commission, the New York members proposed that the Connecticut river should be the divisional line, basing their claim on the letters patent granted by King Charles the Second to James, Duke of York, bearing date March 12, 1663 and April 2, 1674. This proposition was rejected by the

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* N. Y. Col. MSS., lxix. 10.

Massachusetts commissioners; they instead proposing "a line twelve Miles Eastward of Hudson's river."

As neither side would recede from its first proposition the commission adjourned leaving the question of the location of the line in the same unsatisfactory and intangible condition as before.

In 1767 a joint commission was again appointed by the two provinces and met at New Haven, Conn., September 30th of that year. At that meeting the final proposition of the Massachusetts Commission was "That a straight line to be drawn northerly from a point on the south boundary line of the Massachusetts Bay, twenty miles due east from Hudson's river, to another point twenty miles distant due east from the same river, on that line which divided the province of Massachusetts Bay from New-Hampshire, be the eastern boundary of the province of New-York."

As the general direction of the Hudson river is considerably to the east of north, the New York commissioners objected to a line drawn through two points twenty miles distant due east from the river, on the ground that such a partition would give Massachusetts jurisdiction within twenty miles of the Hudson, measuring at right angles therefrom; and instead proposed "That the two provinces be divided by a straight line from the southern to the northern boundary line of the Massachusetts Bay; to begin on the south at the Northwest corner of the oblong, fixed by New York and Connecticut, to be twenty miles from Hudson's river, and run to a point at twenty miles from the said river, in the line between Massachusetts Bay and New-Hampshire; to be found by running a line perpendicular to the main course of that river between the north and south lines of the Massachusetts Bay extended thereto."

Like the preceding commission, neither side would accept the proposal of the other and for a second time the evident hopes which were entertained by both governments for the settling of the jurisdictional line and for a stopping of the quarrels and contentions and riots which were now common among the borderers came to naught.

By act of the New York Assembly, passed March 8th, 1773, "Commissaries" were appointed "to settle a Line or Lines of Jurisdiction, between this colony and the Province of the Massachusetts Bay." Commissioners with like powers having been appointed by Massachusetts, the joint commission met at Hartford, where it was unanimously agreed that "a line beginning at a place fixed upon by the two governments of New-York and Connecticut, in or about the year of our Lord one thousand seven hundred and thirty-one, for the northwest corner of a tract of land commonly called the Oblong, or equivalent land; and running from the said corner north twenty-one degrees, ten minutes and thirty seconds east, as the magnetic needle now pointes, to the north line of the Massachusetts Bay, shall at all times hereafter be the line of jurisdiction between the said province of the Massachusetts Bay and the said province of New-York, in all and every part and place where the said province of New-York, on its eastern boundary, shall adjoin the said province of the Massachusetts Bay."

The course north twenty-one degrees, ten minutes and thirty seconds east is the general course of the Hudson river as determined by survey in the winter of 1772.

A surveying party was at once organized to carry out the terms of the agreement and it seemed that at last this line which had been the cause of debate for over a century was finally to be fixed. Starting from the northwest corner of the oblong the survey had proceeded about six miles when, owing to local attraction, a doubt arose as to whether the line was being run on the agreed upon course. It was then mutually decided to run the rest of the line by "stakes and back sights," although it was known that such a line would tend more easterly than a line run by the needle, as the needle by an increase of variation in going towards the north would describe a curve going westerly. The survey, however, was continued in this manner until it had reached a point twenty miles from the beginning where it was abruptly terminated owing to the refusal of one of the commissioners to consent to the further prolongation of the line except in absolute compliance with the terms of the Hartford agreement.

The troublesome days of the Revolution coming on about this time, no further attempt was made to establish the boundary until 1783 when for a fourth time commissioners were appointed by each State "to complete the running of a jurisdictional line between the State of New York and the State or Commonwealth of Massachusetts." Like their predecessors they ran a few miles of the line, argued, disagreed and disbanded.

Relinquishing all hopes of settling the boundary by their own efforts, both States authorized Congress in 1784 to appoint commissioners to carry into full effect the agreement of 1773. Thomas Hutchins, John Ewing and David Rittenhouse, all distinguished men of high scientific attainments, were accordingly appointed such commissioners by Congress December 2, 1785.

These three commissioners with representatives from New York and Massachusetts met at the south end of the line in July, 1787, prepared for actual field operations. The Hartford Agreement of 1773 by which they were bound, stated that the course should be north 21° 10′ 30″ east as the magnetic needle then pointed.

There being no reliable data as to the yearly variation it was decided to adopt 3′ 5″ per year. This, for fourteen and one-sixth years, would give a variation of 43′ 41″. The actual variation was found to be 5° 3′ west; adding to this the variation for fourteen and one-sixth years it was computed that in May, 1773, the total variation was 5° 46′ 41″ west, which added to the magnetic course as given 21° 10′ 30″ east, made the direction of the boundary line at its starting point 15° 23′ 49″ east of the true meridian. A question then arose as to whether the changes of the magnetic meridian in proceeding northerly should be taken into account in defining the boundary or whether the spirit of the agreement would not be more fully adhered to by determining the direction of the line at the starting point by the needle and continuing on that course with respect to the true meridian. "Your commissioners, in order to compromise this matter, recommended that the boundary line should be a curve which, in proceeding northward, should vary with respect to the true meridian half as fast as the magnetic meridian would do, which was unanimously agreed to by the agents in both of the two States. By observations made at the two ends of the boundary line in 1786 by Dr. Williams, it appeared that the variation at the northern extremity was 49′ 30″ more than at the southern extremity of the line. The boundary was therefore to be a regular curve proceeding at the northern extremity 21′ 45″ more westerly than at its first setting out. Your commissioners afterwards, in order to save time, trouble and expense, proposed, instead of such a curve, to run a straight line or great circle of the globe—that is, to give equal tracts of country to each State that the curve would have done.... The equivalent line was found to be 11′ 40″ more westerly than the curve at the place of beginning—that is 15° 12′ 9″ east of the true meridian, which direction we carefully ascertained by many astromical observations and afterwards pursued the same . . . to the northern boundary of the State of Massachusetts.

The line, as thus established, was accepted by both. States as the jurisdictional line and remained in force in its entirety until the cession of the Boston Corner tract was made.

In the southwest corner of Massachusetts, between the New York boundary line on the west and the high hills of the Taconic range on the east is a triangular shaped piece of land which, owing to its ease of access from New York city and the protection which the topography of the country afforded, had been for a long time the rendezvous of a most vicious and depraved class who were desirous of evading the severity of the law; cut off from the rest of the State by almost impassable hills, a great difficutly was found by the Massachusetts officials in affording to the inhabitants of this tract sufficient police protection.

The disgraceful and notorious incidents connected with the Morrissey-Sullivan prize fight which was held here were of such a character that in 1853, by act of the Senate and House of Representatives of Massachusetts "sovereignity and jurisdiction over that portion of the Commonwealth known as the District of Boston Corner . . . is hereby ceded to the State of New York."

The boundaries of this tract as described on the official map on file in the office of the Secretary of State, are as follows:—"Beginning at a heap of stones . . . . standing in the South Boundary line of Massachusetts and the north west corner of Connecticut . . . . Run thence along the south bounds of Massachusetts in a direct line to the north west corner of the Oblong."

. . . . At the distance of 40 chains . . . established the S. E. corner of Boston Corner . . . . Thence to the eastern line of New York . . . by the true meridian N. 12° 57′ 16″ W. 207.495 . . . . thence on the old State line to N. W. corner of "oblong" S. 15° 12′ 09″ W. 207.985 . . . . Thence to the place of beginning S. 89° 08′ 41″ E. 101.06."

This cession, embracing 1010 acres, was accepted by the New York State Legislature and ratified by act of Congress January 3, 1855.

Joint Final Report of Assistant Engineers in Charge of Field Work.

ALBANY, N. Y., *December* 30, 1899.

Hon. Edward A. Bond, State Engineer and Surveyor of New York, and Mr. Henry B. Wood, Chief Engineer, Topographical Survey Commission of Massachusetts:

Sirs.—The engineers appointed to make a survey of the boundary line between the State of New York and the Commonwealth of Massachusetts respectfully submit the following joint final report:

In 1887 a survey of this line was made by Mr. O. S. Wilson under the direction of the Hon. Elnathan Sweet, State Engineer and Surveyor of New York. It was hoped at that time that co-operation might be arranged with the Massachusetts officials, but as their Legislature had given them no authority, they were compelled to decline, and the monumenting of the line was postponed until joint action could be taken.

The results of this survey were valuable from the fact that they disclosed the unsatisfactory and unstable character of the existing monuments and their approximate divergence from a straight line. A detailed account of the work accomplished and the methods employed on this survey was given by Mr. Wilson in his interesting report embodied in that of the State Engineer and Surveyor for the year 1887.

No further effort was made by either State to have the line properly surveyed until January, 1897, when, in a communication from the State Engineer and Surveyor of New York to the Hon.

Roger Wolcott, Governor of the Commonwealth of Massachusetts, attention was called to the indefiniteness of the line as then marked, and the request was made that Massachusetts co-operate in a joint survey and in marking the line with substantial and permanent monuments. A favorable reply was received, and a meeting was held in Boston at which were present the State Engineer and Surveyor of New York and the members of the Topographical Survey Commission of Massachusetts; at this meeting arrangements were made for proceeding as soon as possible with the field work.

A reconnoissance of the line was made by Mr. Sidney Smith who had been appointed by the Topographical Survey Commission as its field representative, and Mr. C. H. Flanigan, acting for the State Engineer of New York, to devise means for the proper and expeditious handling of the work, and a joint report was made in June, 1897, which stated that the reports of 1787, 1887 and 1890, had been examined and portions of the line visited, and that, inasmuch as the survey of 1887 recovered some of the original transit points near the north and south ends of the line, probably more points might yet be recovered.

The following method was suggested:

" Erect a signal on the 1787 line at Berlin mountain and place a straight line instrument on Alandar mountain, thus covering about forty miles of the line. Between these stations set points upon the intermediate summits and erect signals or flags thereon, thus eliminating errors of transiting.

Also with the straight line instrument project points from Berlin mountain north and from Alandar mountain south to cover the extremities of the boundary; with a lighter and more portable instrument clear and measure the line between the secondary stations, at the same time recovering monuments of 1787 and local monuments set since that time. Such data referred to a straight line may determine the exact location of existing points in the boundary and also the location and value of points in local surveys"

In keeping with the plan suggested by the engineers, an agreement was acceded to by both parties, authorizing a survey and the marking of the line. It was further agreed that each State should furnish one-half of the necessary party, equipment, supplies, etc., and that the actual expenses incurred in the prosecution of the work, including the cost of the reconnoissance and the preliminary report, should be borne equally by the two States in interest, except so far as related to the compensation of the engineers and assistants employed, which compensation was arranged by each State separately, all expenses to be accounted for in verified statements submitted in duplicate and as far as practicable supplemented by receipted vouchers.

Upon the completion of the work, the engineers in charge of the field work were instructed to prepare and file with their respective departments duplicate reports, giving in detail the methods used in establishing the line, the location of the monuments, and any other interesting data.

Sidney Smith, under appointment of the Massachusetts Topographical Survey, and Charles H. Flanigan, representing the State Engineer of New York, were empowered to proceed with the survey, and carry out the requirements of the agreement.

This agreement was amended later by the assignment of Eugene E. Peirce, Assistant Engineer in charge on the part of Massachusetts in place of Sidney Smith, on account of the latter's employment elsewhere.

INSTRUMENTS.

For the long alignment, we had a Buff & Berger straight line instrument. It has three leveling screws, an axis of hardened bell metal and can be accurately centered by a motion of the base. The telescope has an aperture of two inches, magnifying power power of forty diameters and cross hairs of the X design.

The instrument used for running and staking the line between the summit points set by the straight line instrument was a Buff & Berger transit theodolite. It has three leveling screws, a movable head and an eight inch plate reading to 20″. The aperture of the telescope is one and one-half inches, and the magnifying power 27 diameters.

A special four inch B. & B. transit with sensitive level bubbles was used by the chaining party.

In work of this description, it is essential that some means of ready communication in the field be adopted, whereby messages may be transmitted from one party to the other. For this purpose, heliotropes which had been used in the New York State Survey were employed; they were of the Coast Survey pattern, made by Fauth & Co., and W. & L. E. Gurley.

By using the telegraphic code it is possible to send any message with the helitrope. This system has been in use for many years and while simply in operation, is apt to consume much time, and time is an important factor when observing. We arranged a code of signals, a copy of which was furnished to each one of the heliotropers; the code contained all sentences necessary for use during the progress of the work. Each sentence was designated by a special number; for instance, 16 meant "Give me a point," 33, "All right," 97, "Finish for the day," etc. The method pursued in sending messages was as follows: The observer and the heliotropers were at their respective stations at an appointed time; if the weather conditions were favorable, each heliotroper flashed his light to the other. As soon as the flashes were visible, the heliotroper at the observing station cut off his light as a signal that he was ready to send a message; if the heliotroper at the receiving station was prepared to take the message. a similar signal was given in return by him. The message was made by equal intervals of flashes and cut offs.

If we desired to send sentence number eight, it was done by giving eight flashes each of two seconds duration with an equal interval of cut off between them; 43 was made by giving four two-second flashes, then a cut off for five seconds, after which three two-second flashes followed.

This system was readily learned by the heliotropers and in its application gave excellent results.

For chaining two narrow steel tapes were purchased, each 300 feet in length, graduated to feet, except the first and last foot, which were divided into tenths. These tapes had been previously tested on the standard base at Chestnut Hill reservoir, Massachusetts. No 1, showed an elongation in its total length at 82° F. of .019 of a foot, and No. 2, at the same temperature, an elongation of .013 of a foot.

The stadia rods were graduated to correspond to the wire interval of the transit; they were of white pine, of the folding pattern, jointed in the middle four inches wide and seven-eighths of an inch thick. The body ground was painted white, and the sub-divisions, feet, tenths, and half-tenths were indicated by the usual diamond shaped diagrams painted black. No numerical figures appeared on the rods, as in long sights especially, they are likely to cause confusion. In unusally long sights, cardboard targets held in position by elastic bands encircling the rods, were employed.

FIELD WORK.

A field party consisting of 14 men was organized, each State furnishing an equal number. Camp was pitched on the west slope of Alandar mountain, two and one-half miles southeast of the village of Copake Iron Works, and preparations were made to begin work.

Primarily, our duties were to run a base line, coinciding as nearly as possible with the line of 1787, which was reported to be defined by stone heaps and chiseled marks cut in ledges at specified places throughout its length.

From the report of the Wilson survey, we learned that he did not find the bounds to be located on the straight line described in 1787, and that many of the marks that had been made by the commissioners of that date were missing, none having been found that could be positively identified between the eighth-mile point and the forty-first mile point, a distance equal to two-thirds of the entire line. Plotting the Wilson survey line and a line connecting the 10 original monuments identified by him, it was apparent that the divergence of the old monuments from a straight line was irregular, and that no one straight line could connect them all. Averaging their locations, we computed that a line run from the point on Alandar mountain to a point eight feet west of the old stone heap on Berlin mountain, would coincide approximately with all the old monuments as far north as Jim Smith hill. If these points proved to be intervisible, we would be able to control 44 miles of the line.

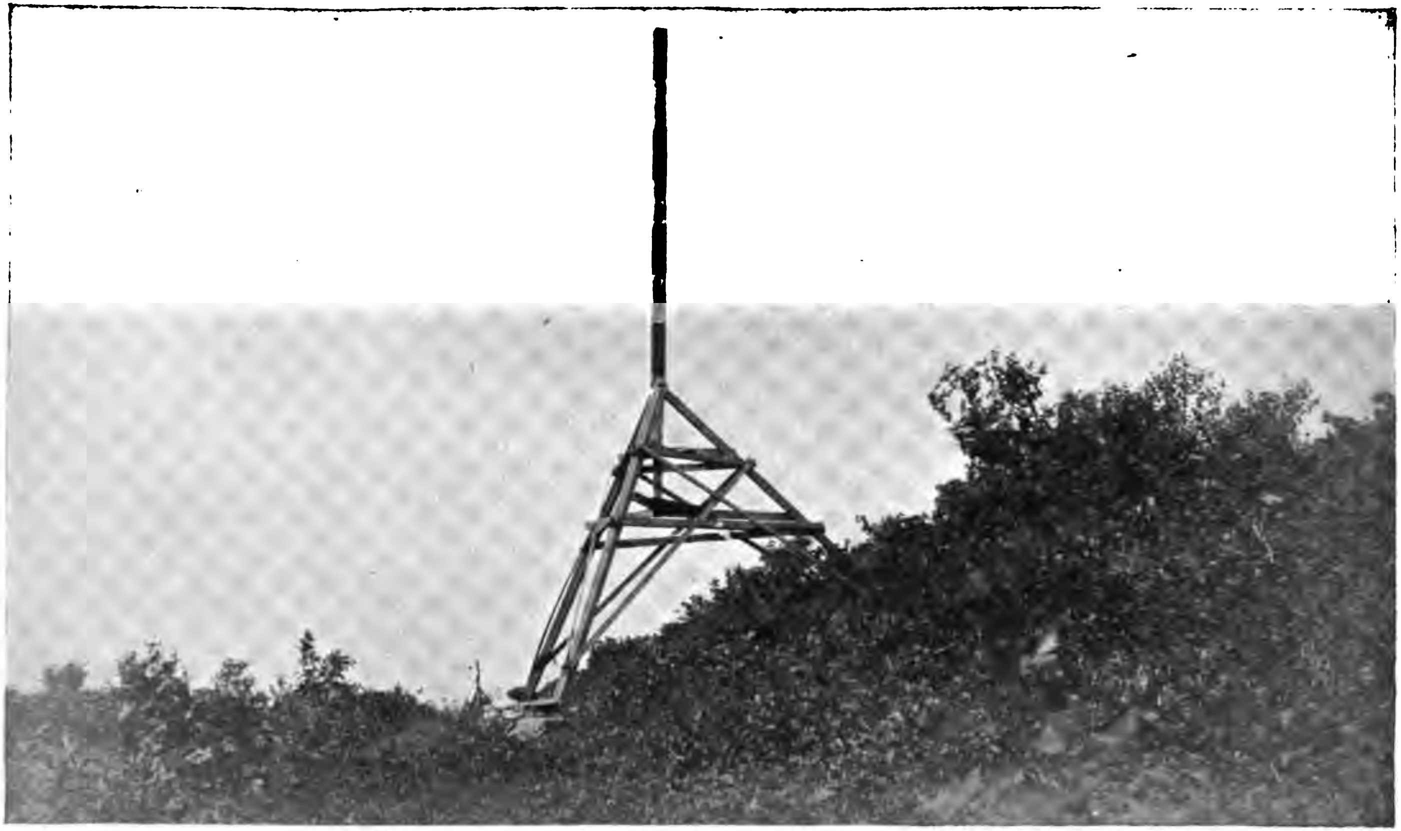
"Alandar," the point chosen on Alandar mountain, was a little east of the center of the old stone heap and averaged well in alignment with the Borden monument at "Boston Corner," the chiseled arrows on Alandar mountain and Prospect mountain, and the stone heap on Dugway hill. On proceeding to Berlin mountain, and attempting to flash a foresight from the point selected there to the party on Alandar mountain, it was seen that the line of sight was cut off by the woods on Rhodes pinnacle and Mount Misery. This necessitated a change in the general plan we had formed of setting a majority of the main points from Alandar with Berlin mountain as a foresight.

Mr. Wilson had reported the location of a stone heap on Mount Misery which he considered to be a mark of the 1787 line, and that Mount Misery and Alandar mountain, distant 38 miles, were intervisible. On investigation, we found on Mount Misery a stone heap four and one-half feet high and three feet in diameter, which had been regarded for years as a point on the original line by people living in the vicinity. Five feet east of the stone heap on our computed line a post was driven on which was mounted a heliotrope to give a foresight from Alandar.

A party was sent to Mount Harvey, 16 1-3 miles north of Alandar, to establish a point on line as soon as the foresight on Mount Misery could be observed from Alandar. As this point was important, and at a greater distance from the observing station than any other that was to be instrumentally determined, extra care and precaution were used in setting it. The tripod of the straight line instrument at Alandar was set on hubs driven firmly into the ground and the entire instrument protected from the wind and sun by a tent. To prevent any vibration that might be caused by movement of the observer around the instrument, a low platform was built for his use. In the tripod of the signal above the instrument was another platform on which the heliotroper stood.

When the summits of Mount Misery and Mount Harvey had been cleared and heliotrope flashes from each had been seen at Alandar, the setting of a point on Mount Harvey was made as follows:

The flash on Mount Misery serving as a foresight, the approximate position of a line point on Mount Harvey was determined. Over this point was erected a simple platform consisting of a single plank five feet long placed at right angles to the line and supported by four posts two feet high. On top of the plank rested a small piece of joist, into which had been screwed a heliotrope. The heliotrope was placed alternately east and west of the approximate point and moved slowly towards it according to the signals of the observer at Alandar, the movements becoming shorter as the line was approached. When the "all right" signal was given the position of the center of the heliotrope was marked on the plank, and the heliotrope was moved to the opposite end of the platform ready for another setting. The average of all points given was taken as the true line. In averaging such points, it is necessary to take them by pairs, each pair consisting of an east-west point and a west-east point; the means of such pairs were usually found to give very accordant results. Eight points were set on Mount Harvey, the distance between the extremes being six and one-quarter inches. The four set by moving from west to east were within a space of one and three-quarter inches, and the four from east to west were within a space of two inches. The means of the eight settings, averaging 1 and 2, 3 and 4, 5 and 6, and 7 and 8,



Triangulation Signal, Alandar. N.Y. and Mass. Boundary Line.

were embraced within a space of nine-sixteenths of an inch. This excellent result was due in a great measure to the relative positions of the stations Mount Misery and Mount Harvey, the difference in angular elevation between them being but a few minutes. The two heliotrope flashes were not only in the field at the same time, but so close together that the slightest turn of the tangent screw was sufficient to move the cross hairs from one to the other. The errors of collimation were totally inappreciable for such a slight difference of altitude.

With Mount Harvey as a backsight, a point was established at "Boston Corner" by transiting from Alander with the straight-line instrument. This instrument was not intended for transiting, but on account of its great steadiness and the excellence of the telescope, it was used for this purpose in preference to the regular transit instruments when the point to be set was distant a mile or more from the observer. A target two feet square, divided into four triangles by lines drawn diagonally from the corners, the upper and lower triangles painted white and the others black, was used instead of a heliotrope in setting this point. The collimation at this station was found to be large, the extremes of eight settings being 13½ inches apart, although the groups themselves were fairly compact. The mean of all points came 13¾ inches east of the Borden monument set to mark the old south-west corner of Massachusetts. These were the only points set from Alandar.

The instrument was then taken to Mount Fray, 5¼ miles north of Alandar, and transited into line between the Mount Harvey and Alander signals. The point having been established, it was used as the observing station for setting targets at Mount Prospect 1 mile south; a station near the eleventh mile point of the

1787 survey 3 miles north; and another 7½ miles north near the old sixth transit post. The eight setting on Mount Prospect came within a space of 2⅞ inches, the four at the eleventh mile point within a space of 2⅛ inches, and the eight at the latter point within a space of 5⅝ inches.

From Mount Harvey, Cunningham hill 4 miles north, and Perrys Peak 8 miles north were established, with Mount Misery as a foresight. Both of the settings were good.

From Perrys Peak, Mount Lebanon, 2¼ miles north, and Rounds mountain 10 miles north, were set with a foresight on Mount Misery. The four points on Mount Lebanon and the four on Rounds mountain were within a space of 2 inches.

This finished the long alignment work for the season of 1897, and while we did not reach as far north as had been expected, yet considering the unfavorable weather during July and August, when long distance work was impossible, we were satisfied with the length of line established.

During the progress of the long distance work a transit party was engaged in running, clearing and staking the line between summit points already established. Owing to the very irregular surface of the country, which oftentimes necessitated short backsights and long foresights, considerable care was necessary to keep on line. Foresights and backsights were taken on plumb bob strings and no foresight accepted as "all right" until it had been checked, at least, three times.

The transit party was followed by a party chaining and taking enough stadia notes to check the chained distances and show in a general way the topography of the country crossed by the line.

In order to expedite the progress of the work and to insure greater accuracy than could be obtained by ordinary methods,

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all measurements were made on the slope, vertical angles taken and distances reduced to the horizontal. The excellent results obtained in the chaining as checked later by the triangulation proved the value of this method. Our allowable limit of error was 1 in 2,000; the results show an average error of 1 in 4,000.

Field work was carried on until November 1st, 1897, when, owing to a lack of funds, it was discontinued for the year. A brief review of the season's work showed that, exclusive of the line from "Boston Corner" to Alandar, about 37 miles of the boundary had been cut, cleared and staked, and that the chaining and topography were completed for a distance of 28½ miles; the base line of the survey from Alandar to Mount Misery was established and the controlling points temporarily marked. About eighty-five monuments, including stone heaps and chiseled marks in ledges supposed to be on the old line, were located by offset distances.

In the early part of June, 1898, field parties were again organized and all necessary preparation made for proceeding with the work. Mr. Eugene E. Peirce, assistant engineer, was appointed to succeed Mr. Sidney Smith in charge of the field work for Massachusetts. Several minor changes were made, but the party as a whole remained about the same as during 1897. We established headquarters at Hancock, Massachusetts, June 21st, and on the following day commenced field operations in the same order that was in force during the latter part of the previous season—the New York party ahead, running and cutting the line, and the Massachusetts party following, chaining and taking topographic notes.

North of Mount Misery the summit points on Rhodes Pinnacle, Berlin mountain and Jim Smith hill were set with the straight line instrument. Of these points, Berlin mountain, 5½ miles north of Mount Misery, is the most important as well as the highest point on the boundary. A platform 12 feet high was erected on Berlin mountain, approximately on line, as it was found that the stone pile on Rhodes Pinnacle which was on line between the point on Mount Misery and the point on Berlin mountain obstructed the view. This point was set from Mount Misery by transiting from a heliotrope stationed at Mount Harvey as a backsight; the collimation error was so slight that the groups overlapped. Sixteen points were given and while they do not show as good agreement as those at other stations, the mean of the set is considered strong.

Rhodes Pinnacle 2½ miles south of Berlin mountain was set from Berlin mountain with a foresight on Mount Misery.

From Berlin mountain points on the two summits of Jim Smith hill, distant respectively about two and one-half and three miles from Berlin mountain, were established by transiting, using Mount Misery as a backsight. The groups on both the summits showed fairly close agreement.

As the north end of the line and the more northerly of the Jim Smith hill summits are not intervisible; station "Pownal" was set by transiting from the latter point with a backsight on Berlin mountain. It is about 1,425 feet north of the northerly end of the line on a small knoll from which the end of the line can be commanded. Foresighting from Pownal to Jim Smith hill, we set a point marking the junction of the base line with the southern boundary of Vermont.

When the chaining and topography of the line were finished, the results were plotted and an examination made to ascertain how nearly we had accomplished our purpose of running a line which should coincide with the line of 1787.

The old line was controlled by seventeen transit points placed on summits of mountains crossed by the line; fourteen of these points were marked by stone heaps, and three by marks chiseled in ledge; the location of two of these three marks relative to the line is given in the old records only approximately. Between the transit points the line had been run by compass, and the mile points marked by stone heaps. The location of these mile points was given so indefinitely that we made little effort to find them, our endeavors being wholly confined to identifying the transit points. Including the 85 monuments reported in 1898, about 125 stone piles, marble and granite bounds, and marks on ledges supposed to have been placed on or near the 1787 line were recovered.

Stone heaps at the best are unsatisfactory marks. There is about them such lack of reliability and want of character that it required at times greater powers of intuition than we possessed to decide whether a stone heap found marked the line of 1787 or was placed there fifty years later by some farmer in clearing his land.

The following table shows a list of the probable transit points of the original line, which were recovered:

Transit Points of 1787 Line Referred to Base Line of 1897-1898 Survey.

Distance in miles.	Name.	Offset in feet.
0.0	Boston Corners first transit post, marble monument	1.1W.
2.5	Alandar Mt. second transit post, stone heap.	0.0
2.5	Alandar Mt. chiseled arrow	1.9W.
5.2	Cedar Mt. stone heap	0.0
6.0	Dugway Hill third transit post, chiseled M.	2.0E.

Distance in miles.	Name.	Offset in feet.
6.6	Mt. Prospect fourth transit post, chiseled arrow	1.8E.
7.7	Mt. Fray fifth transit post, chiseled Y	2.2E.
15.2	Sixth transit post, stone heap	0.0
18.8	Mt. Harvey seventh transit post, stone heap	0.7W.
40.4	Mt. Misery twelfth transit post, stone heap.	5.4W.
41.5	Thirteenth transit post, stone heap	4.0W.
43.3	Rhodes Pinnacle fourteenth transit post, stone heap	0.5E.
45.9	Berlin Mt. fifteenth transit post, stone heap	8.0E.
48.5	Jim Smith Hill sixteenth transit post, stone heap	4.0E.
49.8	*Northwest corner of Massachusetts, granite monument	58.1E.

From this table it will be seen about as many of the old bounds were found on one side of the base line as on the other, and that the general average of these points is well represnted by our straight line. The only locality where any great difference appears is between the sixteenth transit post and the end of the line where, in a distance of one and one-quarter miles, there is an increased divergence to the east of 54.1 feet. The northwest corner of Massachussetts was marked by a granite monument set in 1896 by the joint boundary commission of Vermont and Massachusetts on the spot occupied by the marble post presumably set by Borden. There is little doubt as to the authenticity of the large stone pile marking the sixteenth transit post, and had we

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*The 1787 line is described as terminating at "a Red or Black Oak Tree 3¼ feet Diameter Mark'd on the West Side N Y on the East Side M S, and on the Side Next the Line 1787."

As no such tree could be found in the location indicated on the plan, the above mentioned monument hitherto supposed to be at the northwest corner of Massachusetts is inserted in the table.

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been able to locate the seventeenth transit post which is shown about midway between the sixteenth transit post and the northwest corner, on the original map, we would probably have found it close to our line, as the fact that it could easily have been set from the preceding point renders it unlikely that any large error could have been made here. We may, therefore, conclude that the old line diverged from a straight line at or near the seventeenth transit post.

Between the seventeenth transit post and the northwest corner, in a distance of three-quarters of a mile, the line passes down a steep slope through the woods, there being a difference in elevation between the two points of about 900 feet. We have no record of the instrument used in running this portion of the line, but it is probable that the compass was employed, and that the line was deflected to the east either through local attraction or by adopting Dr. Williams' data, which gave the attraction at the north end of the line 49′ 30″ greater than at the south end.

It may seem strange that the very end of the survey we should find an apparent error, which mars the otherwise excellent work of the 1787 surveyors; but from the meagre records which they have left, it is plain that the survey of the north end of the line was hurried, and that little if any time could have been taken in checking up the work.

HIGHWAY MONUMENTS.

There are monuments on most of the highways crossing the line which for years have been accepted as marking the State line. We could procure no records nor get any information telling how, when or by whom many of them were placed, but it is unlikely that any were set in connection with the original survey.

The following list comprises a description of those found, reference for mileage being made to the 0 of our line at the corner of Connecticut-Massachusetts-New York:

Roberts road, 1.9 miles. This road is now abandoned. On its north side is a white marble monument 2 feet high and 7 inches in section, having the letters N. Y. cut on its west face, M. S. on its east face, and J. T. H. on the south face. It is 2.9 feet east of line.

Bashbish road, 5.2 miles. This road, leading from the village of Copake Iron Works to Mount Washington, is well traveled. No line mark was found on the road, but a few hundred feet to the south is a birch tree 2 feet in diameter, having N. Y. cut on its west side; this tree has for a long time been considered as being close to the boundary. It is 19.0 feet west of line.

Mount Washington-Hillsdale road, 6.7 miles. On its north side is a sawed marble post 1 foot high and 6 inches square. It is 6.0 feet west of line.

Hillsdale-South Egremont road, 9.3 miles. This road is marked by a marble monument 2.3 feet high and 11x4 inches in section, standing on the north side of the road 3 feet south of the wall and leaning slightly to the west and south. It is 15.0 feet east of line.

Hillsdale-North Egremont road, 10.5 miles. No line mark found. On the south side of the road is a frame dwelling known as the "State Line House." Our line passes 10 feet east of the center of this house.

Road at 11 miles. This road is but little used. No line mark found.

North Egremont-North Hillsdale road, 11.8 miles. On the south side of the road a stake was found which, according to the testimony of the owner of the property, marked the line. It is 2.5 feet east of our line.

Whites Hill road, 12.6 miles. But little travel on this road. No mark found. There is a fence on either side of the road which has been considered as being on the State line. It is 16.5 feet west of the line.

Green River-North Egremont road, 13.7 miles. On the southwest side of this road is a cut marble slab 1¾ feet high, 11 inches wide and 6 inches thick, leaning to the south and west. Its northeast face is marked Albany 33 m., its southeast face M. S. Line, and northwest face N. Y. Line. It is 11.3 feet west of line.

Green River-Great Barrington road, 14.4 miles. Little used. No mark found.

Cross road, 14.9 miles. This road is steep and rocky, allowing only light travel. No mark found.

Alford-Green River road, 16.3 miles. No mark found.

Austerlitz-West Stockbridge south road, 20.5 miles. This road is marked on its north side by a cut marble post 2 feet 6 inches high and 7 inches in section. On the east face are cut the letters Mass. and on the west face N. Y. This monument leans a little to the west and is 19.2 feet east of line.

Cross road, 20.6 miles. This road branches from the preceding one about 350 feet east of the line. No mark found.

Austerlitz-West Stockbridge North road, 21.0 miles. On the north side of this road is a marble post 2 feet high and 7 inches in section, leaning to the south. The letters Mass. and N. Y. are cut on the proper faces. It is 24.4 feet east of line.

Cross road, 21.5 miles. On its north side is a marble post 1 foot 10 inches high and 7 inches in section. The letters Mass. and N. Y. are cut on the east and west faces respectively. It is 38.3 feet east of line.

Canaan-West Stockbridge road, 22.0 miles. No mark. In the State Line hotel steps is a sawed marble post 2 feet 5 inches high and 7 inches in section, lettered on its east face Mass. and on its west face N. Y. It is 50.7 feet east of line.

Railroad monument, 22.0 miles. On the south side of the right of way of the Boston & Albany Railroad is a marble post 1 foot 7 inches high and 8 inches by 4 inches in section. This monument was set by the railroad engineers and is 50.1 feet east of line.

Canaan-Richmond Furnace South road, 22.0 miles. A marble post 3 feet high and 6 inches in section stands on the north side of this road. It is marked on its south face Road Line, on its east face Mass. and on the west face N. Y. It is 49.2 feet east of line.

Canaan-Richmond Furnace North road, 23.0 miles. No mark found.

Cross road, 23.2 miles. This road leading over Cunningham hill is little used. No mark found.

Canaan-Richmond road, 24.0 miles. A marble post 3.6 feet high, increasing from five inches at the top to seven inches at the base was found on the south side of this road. The monument is marked on its west side S. L. and on its east side R. It is 0.6 of a foot west of the line.

Cross road, 24.6 miles. No mark found.

Canaan-Pittsfield road, 24.8 miles. On the north side of this road is a roughly dressed marble post 3 feet 8 inches high, tapering from 5 inches at the top to 6 inches at the base. It is marked on its west side S. L. and on its east side R. It is 4.1 feet west of line.

Mount Lebanon-Pittsfield road, 28.3 miles. A large slate slab was found lying on the ground on the north side of the road. On the face of this slab is carved 1818 N. York & Mass. Line 26 M. From Alb'y. The bottom of the stone is 1.6 feet west of line.

Old Lebanon Springs-Pittsfield road, 31.0 miles. This road is now but little traveled. No mark found.

Lebanon Springs-Pittsfield road, 31.3 miles. On the south side of this road was found a cut marble slab 2 feet 3 inches high and 8 inches by 4 inches in section, lettered on the east face Mass. and on the west face N. Y. It is 2.2 feet west of line.

Goodrich Hollow road, 33.5 miles. A marble monument 3 feet high with sides 5 inches in width stands on the south side of the road. It is marked N. Y. on the west face and Mass. on the east face. It is 3.5 feet east of line.

Hancock-Stephentown road, 35.5 miles. On the north side of this road leaning against the stone wall is a marble slab 3 feet 9 inches high, 1 foot 8 inches wide, and 3¼ inches thick, marked on its broad south face Massachusetts and York Line To Albany 25 Miles To Northampton 48 Miles. It is 12.9 feet east of line.

Sweet road, 42.6 miles. This road is seldom traveled, and is little more than a wood road. No mark found.

Mills Hollow road, 44.4 miles. This road crossing the line in three places is little used. No mark found.

Beebe Hollow road, 45.9 miles. This is a very steep wood road and seldom used. No mark found.

Berlin-Williamstown road, 47.3 miles. On the north side of the road loosely supported by small stones is an irregularly shaped slate stone 2 feet by 1 foot in section, marked XVI. It is 29 feet west of line.

South Williamstown-Petersburg road, 48.6 miles. Road used but little. No mark found. South of the road is an old fence bottom extending southerly about parallel with the line for 500 feet. It is 9 feet west of line.

Williamstown-Petersburg road, 48.7 miles. This is the main traveled road over the mountains. No mark found.

Reviewing the locations of the highway monuments, we find them all in fairly good alignment, probably within 12 feet or less, with the exception of the monument at the State Line Hotel, the two to the north of it, and three to the south. Diligent inquiry failed to inform us when or how these monuments were located, but from the regular divergence they show from our line—increasing from 24.4 feet near the twenty-first mile to 50.7 feet at the twenty-second mile—it is probable that many years after the original survey was completed, local surveyors established their positions by the prolongation of a line starting at a mark which they supposed was on the State line, and passing through another farther north and a greater distance east of our line at some point south of the twenty-first mile.

A line extended from the monument on the Boston and Albany railroad through the monument in front of the hotel, will pass through the parlor on the easterly side of the building, rendering that room a very convenient place for Massachusetts couples in which to be married without indulging in the formality of a marriage license. Near the westerly end of the hotel, safely removed from the stringent liquor laws of Massachusetts is the bar-room. The excellent arrangement and location of the hotel relative to the line as we found it marked is striking, so much so that one is led to think that the line was made in this case to fit the hotel, and not the hotel to fit the line. The line, as now marked, will place a greater portion of the hotel and its occupants in and under the jurisdiction of Massachusetts.

TOWN AND COUNTY CORNERS.

There are seven town and one county in Massachusetts and ten towns and three counties in New York bordering upon the State line. The junction of the boundary lines of three New York towns with the State line was marked; the boundary lines of the other seven towns could not be identified and, as the supervisors, after notification, failed to locate them, they were left unmarked. The boundary lines of all the Massachusetts towns were marked by monuments.

In looking for monuments it is usually possible to get some kind of information from the people living in the vicinity of the corner as to its approximate location. It is true that this information is sometimes useless and oftentimes misleading, but it gives one at least something to work on. In the present case, it was impossible to procure even this slight information; the residents knew so little about their town corners that they would not even hazard a guess as to their location. A search in the offices of the county clerks of Rensselaer and Columbia counties developed such lack of information relative to town corners that we believe that they have never been actually marked on the ground.

The location of monuments marking town corners found is as follows:

Mount Washington (Mass.) — Northeast (N. Y.) — Salisbury (Conn.), 0 miles. It is marked by a sawed marble post 3 feet high, its sides 8 inches in width, standing on a low ridge between two summits of the Taconic range, about 600 feet east of Ryan Bush road. It is marked Ms. on the north face, N. Y. on the west face, and Ct. on the east face.

Ancram (N. Y.)—Mount Washington (Mass.)—Northeast (N. Y.), ½ mile. This corner was masked by a sawed marble monument

2 feet in height and 8 inches in section, with 1853 cut on the north face, M. S. on the east face, and N. Y. on the south and west faces. It is on the steep westerly slope of a mountain 2,000 feet west of Ryan Bush road, at the southerly end of the "Hogeboom Line", and at the southwest corner of Massachusetts.

Ancram (N. Y.)—Copake (N. Y.)—Mount Washington (Mass.), 2 miles. A stone pile 3 feet high and 3 feet in diameter at the base marking this corner was placed here in 1857 when the town of Ancram was set off from the town of Copake. It is in woodland at the top of a short slope extending southerly 325 feet to Roberts road. It is 6 inches east of the line.

Copake (N. Y.)—Mount Washington (Mass.) 3.1 miles. A sawed marble monument 2 feet high and 8 inches in section, with 1853 cut on the north face, M. S. on the east face, and N. Y. on the west face. It is on the westerly wooded slope of Alandar Mountain at the northerly end of the "Hogeboom Line", and is 20.0 feet west of the line.

Copake (N. Y.)—Egremont (Mass.)—Mount Washington (Mass.), 8 miles. A rough peaked slab 7 x 14 inches in section, projecting about 2 feet above the top of a stone pile 4 feet high and 5 feet in diameter standing in a thick young growth, on the southerly slope of Mount Fray, marks this corner. It is 6.2 feet east of the line.

Copake (N. Y.)—Egremont (Mass.)—Hillsdale (N. Y.), 9.4 miles. This corner is marked by a granite monument 2.4 feet high, its sides increasing from 7 inches at the top to 8 inches at the base, inscribed on its west face is Town Line Copake and Hillsdale. It stands in a cleared field about 500 feet north of the Hillsdale-South Egremont road and is 11.8 feet east of the line.

Alford (Mass.)—Egremont (Mass.)—Hillsdale (N. Y.), 12.5 miles. A sawed marble monument 1 foot high and 8 inches in section, with 1829 cut on its east face, A on the north face, NY on the west face, and E on the south face, marks this corner. It is in a cleared field 350 feet south of Whites Hill road, and 18.3 feet west of the line.

Alford (Mass.)—Austerlitz (N. Y.)—West Stockbridge (Mass.), 18.1 miles. This corner is marked by a rough marble monument 4 feet high, its east and west faces averaging 7 inches in width, its north and south faces 6 inches at the top and 10 inches at the base, standing in thick woods about a mile south of the summit of Mount Harvey. On its south face is cut A, on its north side M. S., 1841, and on its west face N. Y. It is 49.2 feet west of the line.

Canaan (N. Y.)—Richmond (Mass.)—West Stockbridge (Mass.), 22.1 miles. A sawed marble post marks this corner. It is 1 foot high, its sides about 8 x 4 inches in section. W. Stockbridge is cut on the south face, N. Y. on the west face and Richmond on north face. It stands about 550 feet north of the Boston and Albany Railroad on a wooded slope, and is 55.7 feet east of the line.

Canaan (N. Y.)—Hancock (Mass.)—Richmond (Mass.), 27.4 miles. This corner is marked by a cut marble post 2.5 feet high and 7 x 4 inches in section. On its west face are cut the letters N. Y., on the east face R, and on the north face H. It stands in a cleared field 300 feet north of the highest point on the State line on Perrys Peak, and is exactly on the line.

Berlin (N. Y.)—Hancock (Mass.)—Williamstown (Mass.), 42.2 miles. The monument marking this corner stands on the steep, wooded northerly slope of a mountain, about 2,000 feet south of the Sweet road. It is of granite 3 feet high, its sides 6 inches in width, marked on its north side W, on its south side H, on its west side N. Y., and on top 1898. It is 31.1 feet west of the line.

Petersburg (N. Y.)—Pownal (Vt.)—Williamstown (Mass.), 50.3 miles. This point was marked by the granite monument now set at the three-State corner, as determined by the survey of 1897-1898; it stood a few feet west of a private roadway, in a fence at the foot of a slight rise and was 58.1 feet east of the line.

TRIANGULATION.

As a check on the alignment and chaining of our base line it has been tied at the principal summit points to the Massachusetts system of triangulation. The field notes of the work pertaining to the alignment were turned over to the United States Coast Survey for computation and adjustment and the results are shown in the following table:

Table of Geographical Positions. New York-Massachusetts Boundary Line.

NAME OF STATION	Latitude. ° ′ ″	Seconds in metres.	Longitude. ° ′ ″	Seconds in metres.	Azimuth. ° ′ ″	Back Azimuth. ° ′ ″	To station.	Distance metres.	Logarithms
Mt. Washington (Mass.)—Northeast	42 02 58.427	1802.7	73 29 15.959	367.0	14 36 11.32	194 36 02.83	Brace Mtn. 2	1156.55	3.0631656
(N. Y.)—Salisbury (Conn.)	....	....	....	....	102 00 10.74	281 59 57.73	Bakers Rock	456.83	2.6597575
Ancram (N. Y.)—Mt. Wash'ton No. 1	42 02 58.756	1812.8	73 29 50.737	1166.8	90 45 05.41	270 44 06.52	Boston Corner	2022.05	3.3057917
(Mass.)—Northeast (N.Y.)	....	....	....	....	171 18 26.03	351 18 07.28	Alander Mtn	4254.39	3.6288378
Angle on Alander.									
Copake—Mt. Washington 1	42 05 10.205	314.9	73 30 31.031	713.2	15 12 24	195 12 23.	Alandar	117.04	2.06834
*Alandar	42 05 06.544	201.9	73 30 32.367	743.9	195 12 22.93	15 15 44.57	Mt. Harvey (M—N.Y.)	26209.74	4.4184627
					230 03 24.46	50 03 33.61	Alander Mtn	469.28	2.6120154
Mt. Prospect (M—N.Y.)	42 08 34.166	1954.2	73 29 16.537	379.8	314 57 30.40	134 59 42.82	Bald Peak	6410.93	3.8069208
					13 05 43.46	193 05 01.76	Alandar Mtn	6307.08	3.7998284
Mt. Fray (M—N Y.)	42 09 27.312	842.7	73 28 57.104	1311.0	195 13 26.83	15 15 44.57	Mt. Harvey (M—N.Y.)	17871.74	4.2521669
					326 27 36.85	146 29 26.25	Bald Peak	7402.44	3.8693747
Mt. Harvey (M—N.Y.)	42 18 46.160	1424.3	73 25 32.183	737.0	272 55 51.08	93 07 07.78	Becket	23058.08	4.3628232
					1 30 49.13	181 30 31.04	Bald Peak	23422.26	4.3696289
Perrys Peak (M—N.Y)	42 25 29.149	899.4	73 23 03.760	86.0	320 34 40.96	140 34 51.07	Perrys Peak	539.27	2.7318070
					15 17 24.60	195 15 44.57	Mt. Harvey M—N.Y.)	12889.77	4.1102451
Rounds Mtn. (M—N.Y.)	42 33 56.442	1741.6	73 19 56.137	1280.5	195 19 31.35	15 20 16.23	Mt. Misery (M—N.Y.)	5715.66	3.7572941
					239 39 10.22	59 45 54.33	Greylock	15761.69	4.1976027
Mt. Misery (M—N.Y.)	42 36 55.177	1702.5	73 18 49.822	1135.5	194 50 54.66	14 52 01.97	Berlin Mtn. 2	8824.25	3.9456778
					258 33 57.34	78 39 56.73	Greylock	12335.93	4.0911721
Berlin Mtn. (M—N.Y.)	42 41 30.432	939.0	73 17 07.479	170.2	301 48 09.66	121 52 59.95	Greylock	11483.40	4.0600705
					15 21 25.57	195 20 16.23	Mt. Misery (M—N.Y.)	8807.61	3.9448581
Jim Smith Hill (M—N.Y)	42 44 09.969	307.6	73 16 08.042	183.0	322 33 24.22	142 37 34.34	Greylock	13824.87	4.1406610
					15 22 05.89	195 20 16.23	Mt. Misery (M—N.Y.)	13912.89	4.1434173
Petersburg (N.Y.)—Pownal (Vt.)	42 44 45.201	1394.8	73 15 54.904	1248.7	195 22 14.80	15 22 18.25	Pownal	436.40	2.6398846
—— Williamstown (Mass.)	....	....	....	....	15 22 14.80	195 22 05.88	Jim Smith Hill(M—NY.)	1127.48	3.0521091
§Pownal	42 44 58.837	1815.6	73 15 49.818	1183.0	327 22 54.02	147 26 51.81	Greylock	14822·59	4.1709240
					15 22 18.25	195 22 05.88	Jim Smith Hill(M—N.Y.)	1563.88	3.1942035

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* A station in New York on the line from Petersburg (N.Y.)—Pownal (Vt.)—Williamstown (Mass.) to Copake—Mt. Washington 1 produced southerly 383.99 ft. § A station in Vermont on the line from Copake—Mt. Washington 1 to Petersburg (N.Y)—Pownal (Vt.)—Williamstown (Mass.), produced northerly 1431.75 ft.

Table showing the distances between summits, obtained by chaining, compared with the results obtained by triangulation.

TRIANGULATION STATIONS.	DISTANCE.			ERROR.	
	Miles.	Feet by triangulation.	Feet by chaining.	Feet, Total.	Feet per 1,000 feet.
Conn.—Mass.—N. Y. to Ancram—Mt. Washington—Northeast	0.497	2,624.17	2,624.17	0.00	0.000
Ancram—Mt. Washington—Northeast to Copake—Mt. Wash. 1	2.585	13,648.69	13,647.64	1.05	0.077
Copake—Mt. Washington 1 to Mt. Prospect (M.—N. Y.)	4.052	21,396.20	21,403.85	7.65	0.357
Mt. Prospect (M.—N. Y.) to Mt. Fray (M.—N. Y.)	1.056	5,575.39	5,575.03	0.36	0.065
Mt. Fray (M.—N. Y.) to Mt. Harvey (M.—N. Y.)	11.105	58,634.22	58,632.62	1.60	0.027
Mt. Harvey (M.—N. Y.) to Perry's Peak (M.—N. Y.)	8.009	42,289.19	42,274.18	15.01	0.355
Perry's Peak (M.—N. Y.) to Round's Mt. (M.—N. Y.)	10.084	53,243.89	53,215.65	28.24	0.530
Round's Mt. (M.—N. Y.) to Mt. Misery (M.—N. Y.)	3.554	18,761.95	18,757.77	4.18	0.223
Mt. Misery (M.—N. Y.) to Berlin Mt.—(M.—N. Y.)	5.473	28,896.30	28,894.32	1.98	0.068
Berlin Mt. M.—N. Y.) to Jim Smith Hill (M.—N. Y.)	3.172	16,749.58	16,745.61	3.97	0.237
Jim Smith Hill (M.—N. Y.) to Mass.—N. Y.—Vt.	0.700	3,699.08	3,694.91	4.17	1.129
Conn.—Mass.—N. Y. to Mass.—N. Y.—Vt.	50.287	265,518.66	265,465.75	68.21	0.257

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Table of distances between triangulation stations on the boundary and the initial point at the northwest corner of Connecticut.

Distance from Conn.—Mass.—N. Y. to	Miles.	Feet.
Ancram—Mt. Washington—Northeast	0.497	2,624.17
Copake—Mt. Washington 1	3.082	16,272.86
Mt. Prospect (M.—N. Y.)	7.134	37,669.06
Mt Fray M.—N. Y.)	8.190	43,244.45
Mt. Harvey (M.—N. Y.)	19.295	101,878.67
Perrys Peak (M.—N. Y.)	27.304	144,167.86
Rounds Mt. (M.—N. Y.)	37.389	197,411.75
Mt. Misery (M.—N. Y.)	40.942	216,173.70
Berlin Mt. (M.—N. Y.)	46.415	245,070.00
Jim Smith Hill (M.—N. Y.)	49.587	261,819.58
Mass.—N. Y.—Vt.	50.287	265,518.66

TRIGONOMETRIC ELEVATIONS.

As a check upon the elevations obtained in chaining, a system of rough trigonometric levels starting from a bench on the summit of Perrys Peak was carried in either direction from summit to summit over the entire length of the line, checking on benches at State Line depot on the Boston and Albany Railroad and on the monument at "Boston Corner". By giving the trigonometric elevations a weight of four, and the stadia a weight of one, it was possible to establish approximately the heights of the principal summits crossed by the boundary; a list follows:

	Elevation in feet above mean sea level.
Ancram—Mount Washington—Northeast (Southwest corner of Mass.)	2,010
Copake—Mount Washington 1 (Angle on Alandar Mountain)	2,044
Alandar	2,061
Mount Prospect (M.—N. Y.)	1,900
Mount Fray (M.—N. Y.)	1,908
Mount Harvey (M.—N. Y.)	2,061
Perrys Peak (M.—N. Y.)	1,970

	Elevation in feet above mean sea level.
Mount Lebanon (M.—N. Y.)	1,517
Clover (M.—N. Y.)	1,464
Rounds Mountain (M.—N. Y.)	2,194
Mount Misery (M.—N. Y.)	2,622
Rhodes Pinnacle (M.—N. Y.)	2,699
Berlin Mountain (M.—N. Y.)	2,774
Jim Smith Hill (M.—N. Y.)	2,329
Pownal (M.—N. Y.)	1,526

Marking.

After the completion of the survey of the line, a joint conference was held at Camp Berlin, Williamstown, Mass., August 9th, 1898, the State Engineer of New York and the members of the Massachuseets Topographical Survey Commission being present. The following arrangement for marking the line was made by C. W. Adams, State Engineer and Surveyor, and Desmond Fitzgerald, Chairman Topographical Survey Commission.

1st. It is agreed that the line to be marked by stone monuments and otherwise, as the jurisdictional line between the State of New York and the Commonwealth of Massachusetts, shall be as follows:

Beginning at a point at the northwest corner of Connecticut, marked by a stone monument; thence, running westerly about forty chains, to a marble monument now standing at the southeast corner of the territory known as "Boston Corner", ceded by Massachusetts to New York in 1853; thence running about north twelve degrees fifty-seven minutes sixteen seconds west in a straight line toward a marble monument, known as the "Hogeboom Monument" on Alandar Mountain, till it intersects the base line of the survey just completed from Alandar Mountain to the southerly line of the State of Vermont; thence the line follows the base line of the aforesaid survey to the southerly line of the State of Vermont.

2nd. It is agreed that the line shall be marked by placing stone monuments at each end of said line and at all angles in same.

3rd. Stone monuments shall be placed at such prominent points along said line as shall be agreed upon by the engineers of the parties hereto.

4th. Stone monuments or other marks shall be placed at the end of each mile, measuring from the point of beginning.

5th. Stone monuments shall be placed at the intersection of said boundary line with all roads and railroads.

It is further agreed that the stone monuments, which have been prepared by the State of New York for marking the line, shall be used for marking the mile points so far as practicable. At such summits and mile points, where it is not practicable to place stone monuments, a cast iron monument of small dimensions shall be used, secured into the rock whenever practicable, and supported by pyramids of small stones laid in cement, the design of the iron monument to be prepared by the engineer of the Topographical Survey Commission, who shall also have charge of procuring the monuments.

At the road crossings and summits, where such monuments can be taken at a reasonable expense, stone monuments similar to those now being placed on the boundary line between Massachusetts and Rhode Island, are to be used, the same to be obtained from the party now furnishing the Rhode Island monuments, if they can be obtained upon as favorable terms as those monuments.

It is further agreed that at the Shaker Village road, the old 1818 stone monument, now lying on the ground alongside of the line, shall be reset on the line, in addition to a new roadstone.

At the intersection of the State line with all town corners, the existing corner monuments shall be reset at such intersections, first obtaining the assent of the town authorities thereto.

None of the monuments now standing as marks of the State line to be disturbed except in cases where a new monument is to be set simply to replace the old one, without changing its location.

To mark the line according to the terms of this agreement required forty-seven monuments of the Massachusetts-Rhode Island type, thirty-six "New York" monuments, and twenty-six iron posts in addition to the three old monuments which were reset.

The monuments marking the boundary are, therefore, with the exceptions noted, of three standard types:

1st. Those similar to the Massachusetts-Rhode Island monuments placed at road crossings, at the junction of the State and town lines, and on the summit of Rounds Mountain, were cut to approved specifications and furnished under contract by D. H. Reed, Fitzwilliam, N. H. These monuments, weighing from 1,700 to 2,000 pounds, are of light-colored New Hampshire granite, about 9 feet in length, the top and upper 3 feet being dressed 12 inches square. On the east face are cut the letters Mass.; on the west face the letters N. Y., and on either the north or south face 1898. In cases where the monuments marks a town line junction, the initial letters of the respective towns are cut on the proper faces.

2d. The "New York" monuments set at a portion of the mile points and summits are from the quarries of John Beattie, of Leete's Island, near New Haven, Conn., being those ordered in 1887 to mark the Wilson survey. They are of flesh-colored granite weighing about 800 pounds, 5 feet in length, dressed on top and 1 foot below, 12 inches square. On the east face is cut the letter M, on the west N. Y. Those marking miles have, in addition, the number of the mile with the letter M beneath it cut on the south face, the initial point being the corner of Connecticut, Massachusetts and New York.

3d. At summits and mile points where it was not practicable to place stone monuments,iron posts furnished by the Chelmsford Foundry Company, of Chelmsford, Mass., were used. They are of cast iron, 5 feet long circular in section, increasing in external diameter from 3 inches at the top to 4 inches just above the bottom, whence the casting broadens out to a base 12 inches in length and 4 inches in width. The casting terminates in an elliptical-shaped head 1⅜ inches thick, its major axis 8¾ inches long. On the east face of the head are cast the letters $\begin{matrix}\text{Mass.}\\ 1898\end{matrix}$, and on the west face N. Y. When the posts were used to mark mile points, the number of the mile followed by the letter M was in most cases cast under the N. Y.

The exceptions are the old post on the "Shaker Village road," mentioned in the agreement made at Camp Berlin, the granite post set in cement at the corner of Berlin-Hancock-Williamstown, and the post marking the corner of Massachusetts, New York and Vermont, all of which are described elsewhere. The markings of the twenty-second and twenty-third mile points were omitted, as they fell in the traveled way in close proximity to roadstones.

The granite posts are set in excavation made to a depth great enough to insure permanency of position. The iron posts are firmly placed in rubble masonry laid in cement.

It may be of interest to describe the method pursued in setting the iron posts. As previously stated, they were set as mile posts in numerous cases. Their station, of necessity, being a definite point, suitable places for their location were not always secured.

In case the point to be marked came on an outcrop of ledge, a level seat was cut in the rock and two 1½-inch holes drilled to a depth of 8 inches. Into these holes, which are exactly on the base line, iron bolts 1⅛ inches in diameter and 13 inches in length were wedged and grout poured around each. The iron post was then set in a bed of cement, the bolts passing through holes made in the base of the casting, allowing the ends, in which a thread was cut, to project about 2 inches. Nuts were screwed securely in place, and grout poured around and over the base and bolts.

A cement masonry pier was built around the post to a height of 2½ feet, the size varying somewhat, but as a rule tapering from a diameter of 3 feet at the base to 1½ feet at the top.

In a majority of cases, it was necessary to excavate from 6 inches to 3 feet before ledge was found. Some of the posts are set upon masonry foundation or upon large boulders placed at the bottom of excavations where ledge was not found.

The work of monumenting the line was divided between the two parties. The New York party were to set the monuments from the northwest corner of Connecticut to and including the bound marking Canaan-Richmond-West Stockbridge (Numbers 1 to 57, inclusive), a distance of twenty-two miles; from this corner to the Vermont line, a distance of twenty-eight miles, the monuments were to be placed by the Massachusetts party.

A delay of a month occurred after the monuments were ordered before they were delivered at the respective railroad stations to

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which they were shipped. On the arrival of the monuments they were distributed to their proper places on the line, and the work of setting was begun at once. Owing to a scarcity of funds, the New York field party was disbanded for the season October 3rd, after setting three monuments on their end of the line. Those on the Massachusetts section were all set during the months of September and October, 1898.

In August, 1899, a field party with Mr. Merritt Peckham, Jr., in charge, took up the work of setting the remaining monuments on the southerly section of the line; this work was completed the latter part of October.

A detailed description of the location of the monuments now marking the line follows:

DESCRIPTION OF THE MONUMENTS ON THE NEW YORK-MASSACHUSETTS LINE.

Number 1. Granite post 9.2 feet in length; Mass. cut on the northeast face, N. Y. on the southwest face, 1898 on the northwest face. The post marks the northwest corner of Connecticut, and is the initial point of the Massachusetts-New York line. It is set 2½ feet in rocky loam and 3 feet in excavation made in shale ledge on the side of a wooded mountain peak, at a point 609 feet east of the roadstone on the westerly side of the Ryan Bush road (wood road).

Number 2. Granite post 8.8 feet in length; Mass. cut on the north face, N. Y. on the south face, 1898 on the west face. It is set 2¾ feet in loam and 2¼ feet in excavation made in shale ledge on the northerly wooded slope of the mountain, on the westerly side of Ryan Bush road (wood road), 1.4 miles northwesterly from its junction with the road leading from the Union church, Mount Washington, to Mount Riga, Salisbury.

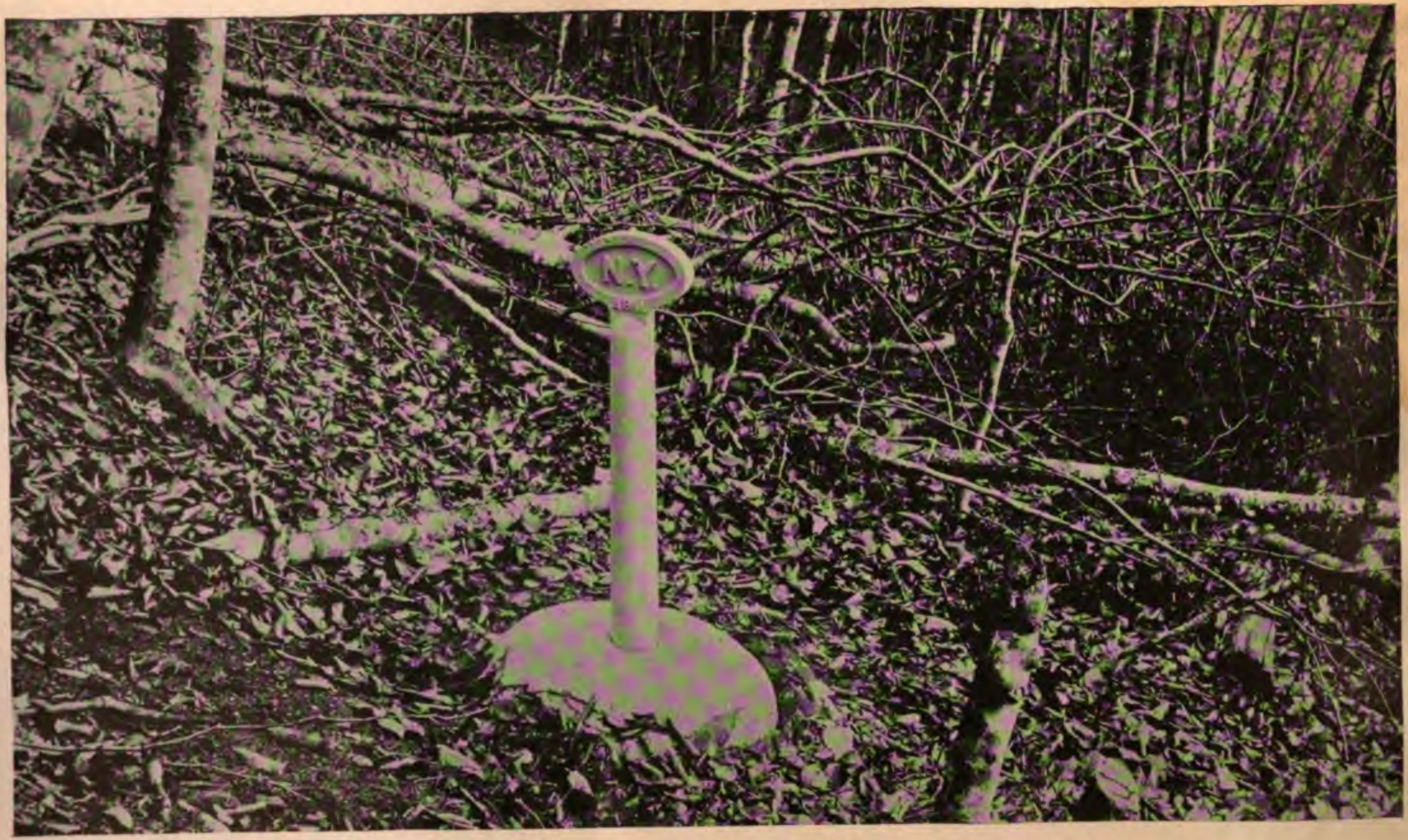
Number 3. Granite post 9.1 feet in length; Mass. cut on the northeast face, Mt. W. 1898 on the northwest face, N. E. on the southeast face. It is set 5½ feet in excavation made in shale ledge on the steep, westerly slope of a partly wooded mountain, 2,015 feet westerly from the roadstone on the westerly side of Ryan Bush road (wood road).

Number 4. Iron post; Mass. 1898 cast on the east face, N. Y. 1 M. on the west face. It is set with its base 1½ feet below the surface of the ground, and resting on top of shale ledge on the steep, westerly, wooded slope of a mountain, 4,855 feet southerly from the roadstone on the northerly side of Roberts road (wood road).

Number 5. Granite post 8.8 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 5 feet in excavation made in loam and hard pan, and 1 foot in gray flint ledge, on the westerly side of Roberts road about 60 feet west of the old Roberts farm, on the westerly wooded slope of a mountain.

Number 6. Granite post 9.8 feet in length; Mt. W. Mass. cut on the east face, C. A. N. Y. on the west face, 1898 on the south face. It is set 2½ feet in loam and 4 feet in excavation made in shale ledge on the southerly wooded slope of a mountain, 330 feet northerly from the roadstone on Roberts road (wood road).

Number 7. Granite post 5.1 feet in length; M. cut on the east face, N. Y. on the west face, 2 M. on the south face. It is set 1 foot in loam and 2½ feet in flint ledge on the southerly wooded slope of a mountain, 425 feet northerly from the roadstone on Roberts road (wood road).



Type of Iron Post, New York and Mass. Boundary Line.

Number 8. Granite post 5.3 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{3}{\text{M.}}$ on the south face. It is set 2½ feet in excavation made in flint ledge on the southwesterly slope of Alandar mountain a few feet north of a steep cliff.

Number 9. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 4¾ feet in excavation made in flint ledge on the westerly wooded slope of Alandar mountain, about ¼ mile west of its summit.

Number 10. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, $\overset{\text{N. Y.}}{\text{4 M.}}$ on the west face. It is set with its base resting on a shelf cut into the face of a ledge on the steep, western, wooded slope of a mountain.

Number 11. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, N. Y. on the west face. It is set with its base resting at the bottom of an excavation made 2 feet in ledge on the steep, westerly wooded slope of a mountain.

Number 12. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, $\overset{\text{N. Y.}}{\text{5 M.}}$ on the west face. It is set with its base resting on a shelf cut into the northerly face of a flint ledge on the extermely steep northerly wooded slope of Pine mountain, about 1,200 feet south of the Bashbish road.

Number 13. Granite post 9.3 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 6 feet in rocky gravel in the banking on the northerly side of Bashbish road.

Number 14. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, N. Y. on the west face. It is set with its base resting on a shelf cut into an outcrop of ledge at about the highest point of Cedar mountain, in a low growth of scrub oak and yellow pine.

Number 15. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{6}{\text{M.}}$ on the south face. It is set in excavation made 3½ feet in rocky gravel on the steep northerly wooded slope of Cedar mountain, 300 feet south of the brook.

Number 16. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, N. Y. on the west face. It is set with its base resting on ledge at the bottom of an excavation made 2½ feet in loam and 6 inches in shale ledge, in a low growth of scrub oak and yellow pine, at about the highest point of Dugway hill, 785 feet south of the road leading to " Sunset rock."

Number 17. Granite post 8.2 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 5 feet in rocky loam on the northerly side of " North Mountain " road which leads from Mount Washington to Hillsdale, 57 feet west of the northwest corner of Mr. Dean's summer cottage on the northerly slope of Dugway hill.

Number 18. Granite post 5.1 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{7}{\text{M.}}$ on the south face. It is set 1 foot in loam and 3 feet in excavation made in shale ledge on the southerly wooded slope of Mount Prospect, about 1,450 feet north of the Mount Washington-Hillsdale road.

Number 19. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, N. Y. on the west face. It is set with its base resting at the bottom of an excavation made 1 foot in shale ledge, at about the highest point of Mount Prospect.

Number 20. Granite post 8.6 feet in length; $\begin{array}{c}\text{Mt. W.}|\text{E.}\\ \text{Mass.}\end{array}$ cut on the east face, $\begin{array}{c}\text{C.}\\ \text{N. Y.}\end{array}$ on the west face, 1898 on the north face. It is set in excavation made 3½ feet in loam and 1½ feet in rocky hard pan, on the southerly wooded slope of Mount Fray, about 40 feet east of a wood road.

Number 21. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\begin{array}{c}\text{8}\\ \text{M.}\end{array}$ on the south face. It is set in excavation made 4 feet in loam on the southerly wooded slope of Mount Fray, 40 feet east of a wood road.

Number 22. Iron post; $\begin{array}{c}\text{Mass.}\\ \text{1898}\end{array}$ cast on the east face, N. Y. on the west face. It is set with its base resting at the bottom of an excavation made 1½ feet in shale ledge on Mount Fray, at about the highest point on the State line.

Number 23. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face. It is set in excavation made 4 feet in loam at the foot of the northerly slope of Mount Fray, in cultivated land about 10 feet west of the trunk of an apple tree.

Number 24. Granite post 9.1 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in loam and clay on the southerly slope of a bare rise, 3½ feet southwest of a wall on the northeasterly side of the road leading from Hillsdale to South Egremont.

Number 25. Granite post 9.3 feet in length; $\begin{array}{c}\text{E.}\\ \text{Mass.}\\ \text{1898}\end{array}$ cut on the east face, $\begin{array}{c}\text{H.}|\text{C.}\\ \text{N. Y.}\end{array}$ on the west face. It is set in excavation made 6½ feet in loam and clay in open pasture on the southerly slope of a mountain, 500 feet north of the Hillsdale-South Egremont road.

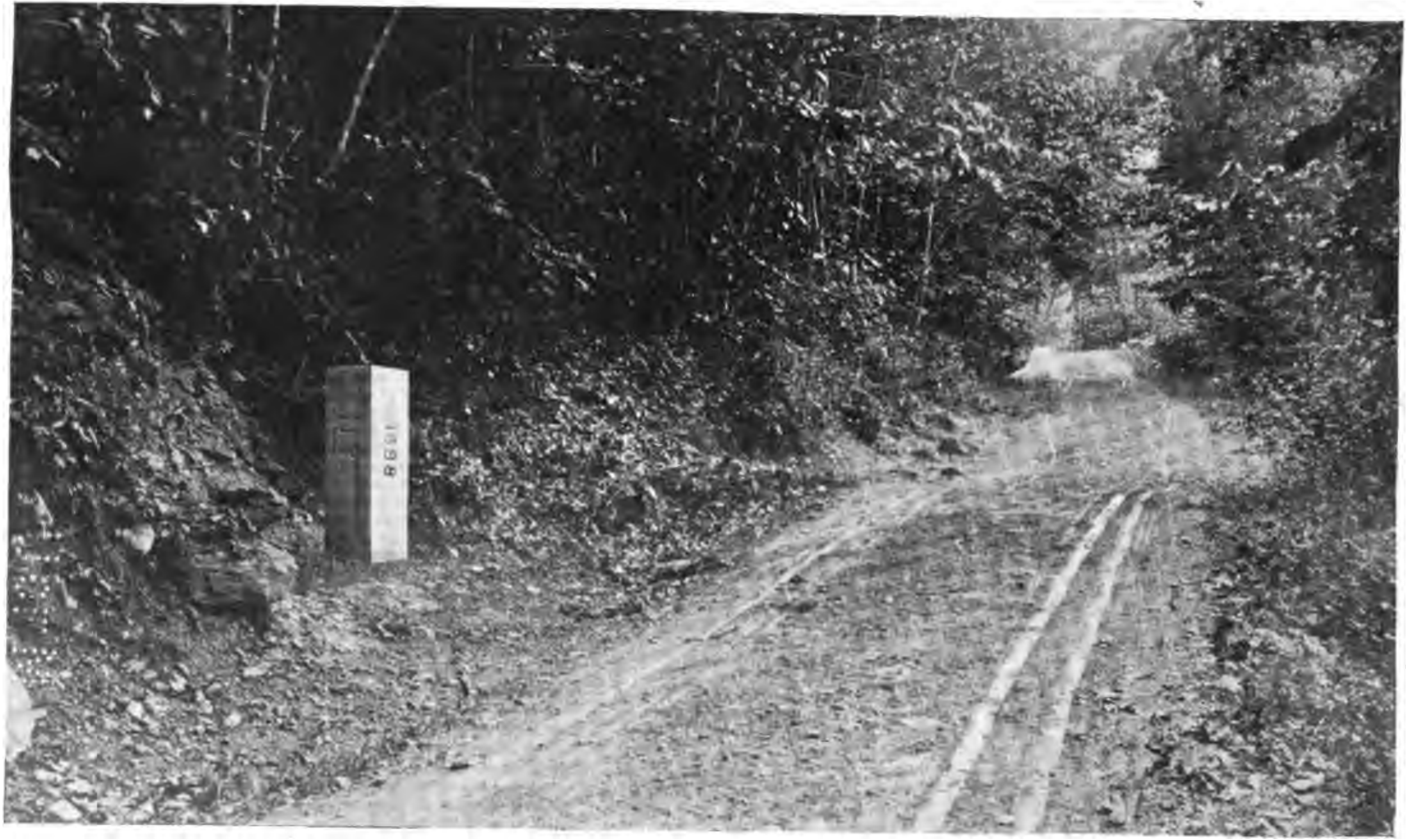
Number 26. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\frac{10}{\text{M.}}$ on the south face. It is set in excavation made 3½ feet in shale ledge on the southerly slope of a mountain in partly wooded pasture land, about ¼ mile south of the Hillsdale-North Egremont road.

Number 27. Granite post 8.8 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in loam and rotten slate ledge, 9 feet south of the fence on the northerly side of the Hillsdale-North Egremont road, 115 feet north of the northerly side of a 1½ story dwelling on the southerly side of the road.

Number 28. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\frac{11}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in loam and slate ledge, in a garden 85 feet south of the fence on the southerly side of a slightly used road, and 82 feet southeast of the easterly corner of the dwelling owned by Sarah Decker.

Number 29. Granite post 9.1 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 2½ feet in loam and 2½ feet in excavation made in shale ledge in the banking on the southerly side of the North Egremont-North Hillsdale road, on the easterly slope of a mountain, and about 100 feet west of a point in the road opposite the dwelling of John Shufelt, which is situated about 100 feet north of the road.

Number 30. Granite post 4.7 feet in length; M. cut on the east face, N. Y. on the west face, $\frac{12}{\text{M.}}$ on the south face. It is set



Type of Highway Monument, New York and Mass. Boundary Line.

in excavation made 3½ feet in loam, at a level spot on the easterly wooded slope of a mountain, about 860 feet north of the North Egremont-North Hillsdale road.

Number 31. Granite post 8.2 feet in length; $\overset{\text{E.|A.}}{\text{Mass.}}$ cut on the east face, $\overset{\text{H.}}{\text{N. Y.}}$ on the west face, 1898 on the south face. It is set 2 feet in loam and 2 feet in excavation made in shale ledge on the northerly wooded slope of a mountain, 50 feet north of a fence dividing the woodland from open pasture to the north, and 360 feet south of the Whites Hill road.

Number 32. Granite post 8.8 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 3 feet in loam and 1½ feet in excavation made in shale ledge on the easterly slope of the mountain, 3 feet south of the center of a Virginia fence on the northerly side of Whites Hill road, which leads westerly from the North Egremont-Green River road.

Number 33. Iron post; $\overset{\text{Mass.}}{\text{1898}}$ cast on the east face, $\overset{\text{N.Y.}}{\text{M.}}$ on the west face. It is set with its base resting on the top of a flat rock about 30 inches by 8 inches, placed at the bottom of an excavation made 2½ feet in loam on the northerly wooded slope of a mountain, about 500 feet north of the northeast corner of an extensive tract of cultivated land.

Number 34. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 5 feet in loam and wet clay on a level strip of land 1 foot northeast of the fence on the southwesterly side of Green River-North Egremont road.

Number 35. Granite post 4.6 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{\text{14}}{\text{M.}}$ on the south face. It is set in excavation made 3¾ feet in loam and clay on the southerly slope of a cultivated hill.

Number 36. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 5½ feet in loam and clay on a level strip of land on the northerly side of the Green River-Great Barrington road, 31.6 feet south of the southeasterly corner of Joseph F. Dunn's dwelling.

Number 37. Granite post 8.5 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 2 feet in loam and 2¾ feet in slate ledge, about in the line of an old wall on the westerly side of a little-used cross road.

Number 38. Granite post 5.8 feet in length; M. cut on the east face, N. Y. on the west face, $\frac{15}{\text{M.}}$ on the south face. It is set 1 foot in loam and 3½ feet in excavation made in flinty slate ledge about 225 feet east of a little-used cross road, on a ledgy rise a few feet west of a group of white pines.

Number 39. Granite post 5.1 feet in length; M. cut on the east face, N. Y. on the west face. It is set 2 feet in loam and 2 feet in excavation made in flinty slate ledge, at the westerly edge of woodland and at the highest point on the State line on the westerly slope of a mountain, about 500 feet east of the ruins of a house on the westerly side of a little-used cross road.

Number 40. Granite post 5.3 feet in length; M. cut on the east face, N. Y. on the west face, $\frac{16}{\text{M.}}$ on the south face. It is set 2½ feet in loam and 1½ feet in excavation made in slate ledge on the northerly wooded slope of a mountain, about 225 feet east of a wood road, and about ¼ mile south of the Alford-Green River road.

Number 41. Granite post 9.2 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 2 feet in loam and 2½ feet in excavation made in rotten slate ledge on the easterly slope of a mountain, 4½ feet south of the wall on the northerly side of the Alford-Green River road and about 500 feet easterly from James Phillips' dwelling.

Number 42. Granite post 9.1 feet in length; Mass. cut on the east face N. Y. on the west face, 1898 on the north face. It is set in excavation made 5½ feet in wet clay, in a ravine on the northerly side of a discontinued road, about 500 feet west of the dwelling of Harrison Calkins.

Number 43. Granite post 5 feet in length; M cut on the east face, N. Y. on the west face, $\overset{17}{\text{M.}}$ on the south face. It is set in excavation made 2 feet in loam and 2 feet in clay, in cultivated land on the easterly slope of a mountain, 450 feet northwest of the dwelling of Harrison Calkins.

Number 44. Iron post; $\overset{\text{Mass.}}{1898}$ cast on the east face, $\overset{\text{N. Y.}}{\text{18 M.}}$ on the west face. It is set with its base resting on a masonry foundation at the bottom of an excavation made 3 feet in sand and loam, on the steep northerly wooded slope of a mountain, 110 feet south of a brook and ravine.

Number 45. Granite post 9.3 feet in length; $\overset{\text{A.|W. S.}}{\text{Mass.}}$ cut on the east face, $\overset{\text{A.}}{\text{N. Y.}}$ on the west face, 1898 on the north face. It is set 6 inches in loam and 5 feet in excavation made in shale ledge, about 300 feet north of a wood road on the steep southerly wooded slope of a mountain, and 450 feet north of a brook and ravine.

Number 46. Iron post: $\genfrac{}{}{0pt}{}{\text{Mass.}}{1898}$ cast on the east face, $\genfrac{}{}{0pt}{}{\text{N. Y.}}{\text{19 M.}}$ on the west face. It is set with its base resting on the top of a ledge 1½ feet below the surface of the ground, 5 feet north of a stone wall on the easterly wooded slope of a rise, and a few feet south of an extensive open pasture.

Number 47. Granite post 5.4 feet in length; M. cut on the east face, N. Y. on the west face. It is set in excavation made 4¼ feet in shale ledge on the summit of Mount Harvey 4¾ feet west of a wall running nearly on the State line, and dividing woodland on the east from open pasture on the west.

Number 48. Iron post; $\genfrac{}{}{0pt}{}{\text{Mass.}}{1898}$ cast on the east face, $\genfrac{}{}{0pt}{}{\text{N. Y.}}{\text{20 M.}}$ on the west face. It is set with its base resting on masonry at the bottom of an excavation made 2 feet in sand and loam, on the northerly wooded slope of Mount Harvey, 1,200 feet south of cultivated land.

Number 49. Granite post 9.1 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in loam on a level strip of land 3 feet north of the fence on the southerly side of the Austerlitz-West Stockbridge south road, about 325 feet west of the junction of a cross road.

Number 50. Granite post 9.5 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 3 feet in loam and 3½ feet in clay, 1¾ feet north of the fence on the southerly side of a cross road, and 20 feet north of the northerly side of a 1½ story house owned by Miss Fanny Van Dusen. It is about 300 feet north of the junction of the cross road with the Austerlitz-West Stockbride south road.

Number 51. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in loam and sand in the fence on the southerly side of the Austerlitz-West Stockbridge north road, on a fairly level strip of open land.

Number 52. Granite post 5.2 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{21}{\text{M.}}$ on the south face. It is set 3¾ feet in excavation made in loam, 5 feet north of the fence on the northerly side of the Austerlitz-West Stockbridge north road, and 47 feet north of the roadstone on the southerly side of the same road.

Number 53. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 6 feet in excavation made in loam on a level strip of cultivated land, 3¾ feet south of a bar-way in the wall on the northerly side of a cross road.

Number 54. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 6 feet in excavation made in gravel and clay on the southerly side of the Canaan-West Stockbridge road, 8.8 feet east of the northeast corner of a shed at the northwest corner of the State Line hotel.

Number 55. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face. It is set in excavation made 4 feet in cinder filling and clay, 23 feet north of the north rail of the double tracks of the Boston and Albany railroad.

Number 56. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 6 feet in excavation made in wet loam and gravel, 6¼ feet south of a fence on the northerly side of the Canaan-Richmond Furnace south road.

Number 57. Granite post 9.3 feet in length; $\overset{\text{W.S.|R.}}{\text{Mass.}}$ cut on the east face, $\overset{\text{C.}}{\text{N. Y.}}$ on the west face, 1898 on the south face. It is set 5 feet in loam and 1 foot in excavation made in rotten slate ledge, on the steep southerly wooded slope of a mountain about 450 feet north of the Canaan-Richmond Furnace south road.

Number 58. Granite post 9.5 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6½ feet in hard clay, in the fence on the southerly side of the Canaan-Richmond Furnace north road, 250 feet west of the junction of a road leading northerly over Cunningham hill.

Number 59. Granite post 9.3 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6½ feet in clay on the southerly slope of Cunningham hill, and in the fence on the easterly side of the road leading northerly over the easterly slope of the hill.

Number 60. Granite post 5.6 feet in length; M. cut on the east face, N. Y. on the west face. It is set in excavation made 4 feet in wet loam and clay in cultivated land at the highest point on the State line on Cunningham hill, and 250 feet east of the Cunningham hill road.

Number 61. Granite post 5.2 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{24}{\text{M.}}$ on the south face. It is set in excavation made 1½ feet in loam and 2½ feet in clay, in cultivated land on the easterly slope of Cunningham hill 175 feet south of the Canaan-Richmond road.

Number 62. Granite post 9.2 feet in length; Mass cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 2 feet in loam and 3½ feet in clay, on the easterly slope of Cunningham hill and in the fence on the southerly side of the Canaan-Richmond road, 160 feet easterly of the junction of a cross road.

Number 63. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in loam and clay, 5 feet southeast of a wall on the northwest side of a cross road, in undulating woodland.

Number 64. Granite post 8.7 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 5¾ feet in loam and clay, in level cultivated land on the southerly side of the Canaan-Pittsfield road, 300 feet westerly from the junction of a cross road.

Number 65. Granite post 4.8 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{25}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in wet loam, in open pasture on the southerly slope of a bare hill, about 1,000 feet north of the Canaan-Pittsfield road.

Number 66. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{26}{\text{M.}}$ on the south face. It is set in excavation made 1 foot in loam and 3 feet in shale ledge, in open, undulating pasture on the easterly slope of a slight rise, 130 feet northwest from the junction of 3 walls.

Number 67. Granite post 5.5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{27}{\text{M.}}$ on the south face. It is set in excavation made 2 feet in loam and 2 feet in hard clay on the westerly slope of Perrys Peak near the northerly edge of a clump of birches, in open pasture.

Number 68. Granite post 9 feet in length; $\overset{\text{R. H.}}{\text{Mass.}}$ cut on the east face, $\overset{\text{C.}}{\text{N. Y.}}$ on the west face, 1898 on the south face. It is set in excavation made 5 feet in shale ledge, in a fence running east and west through open pasture, on the westerly slope of Perrys Peak.

Number 69. Granite post 5.1 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{28}{\text{M.}}$ on the south face. It is set 2 feet in loam and 2 feet in excavation made in ledge, in a hollow in open, undulating pasture on the northerly slope of Perrys Peak.

Number 70. Slate stone post 8 feet in length and 1.7 inches by 0.6 of an inch in section. On its northerly face is cut the following inscription:—"1898 1818 N. York & Mass. Line. 26 M. from Alb'y." It is set in excavation made 4 feet in loam. It is in a fence at the top of a steep bank on the southerly side of the Mount Lebanon-Pittsfield road.

Number 71. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in stony gravel, in a fence on the northerly side of the Mount Lebanon-Pittsfield road, on a high banking formed by a cut in the highway.

Number 72. Granite post 9.6 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 6 feet in loam and clay on the southwesterly slope of a bare rise at the northerly side of the State highway.

Number 73. Granite post 5.5 feet in length; M. cut on the east face, N. Y. on the west face, $\genfrac{}{}{0pt}{}{29}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in clay, on cultivated land on the southwesterly slope of a bare rise, and about 75 feet east of the State highway.

Number 74. Granite post 5.2 feet in length; M. cut on the east face, N. Y. on the west face. It is set 1 foot in loam and 2¾ feet in excavation made in shale ledge, in cultivated land at the highest point on the State line on the westerly slope of Mount Lebanon.

Number 75. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\genfrac{}{}{0pt}{}{30}{\text{M.}}$ on the south face. It is set in excavation made 1 foot in loam and 3 feet in gravelly clay, 1 foot west of a fence, on fairly level cultivated land, 225 feet south of the eastern terminus of the " Brickyard Shaker " road.

Number 76. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\genfrac{}{}{0pt}{}{31}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in clay, in cultivated land about 200 feet south of the old Lebanon Springs-Pittsfield road on the westerly slope of a slight rise.

Number 77. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set in excavation made 2 feet in loam and 3½ feet in clay, in a fence on the northerly side of the old Lebanon Springs-Pittsfield road, on the southerly slope of a bare rise.

Number 78. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 2 feet in loam and 3½ feet in clay on the westerly slope of a bare rise, in a line of maple trees on the southerly side of the Lebanon Springs-Pittsfield road, 350 feet east of the junction of the road leading to Columbia Hall.

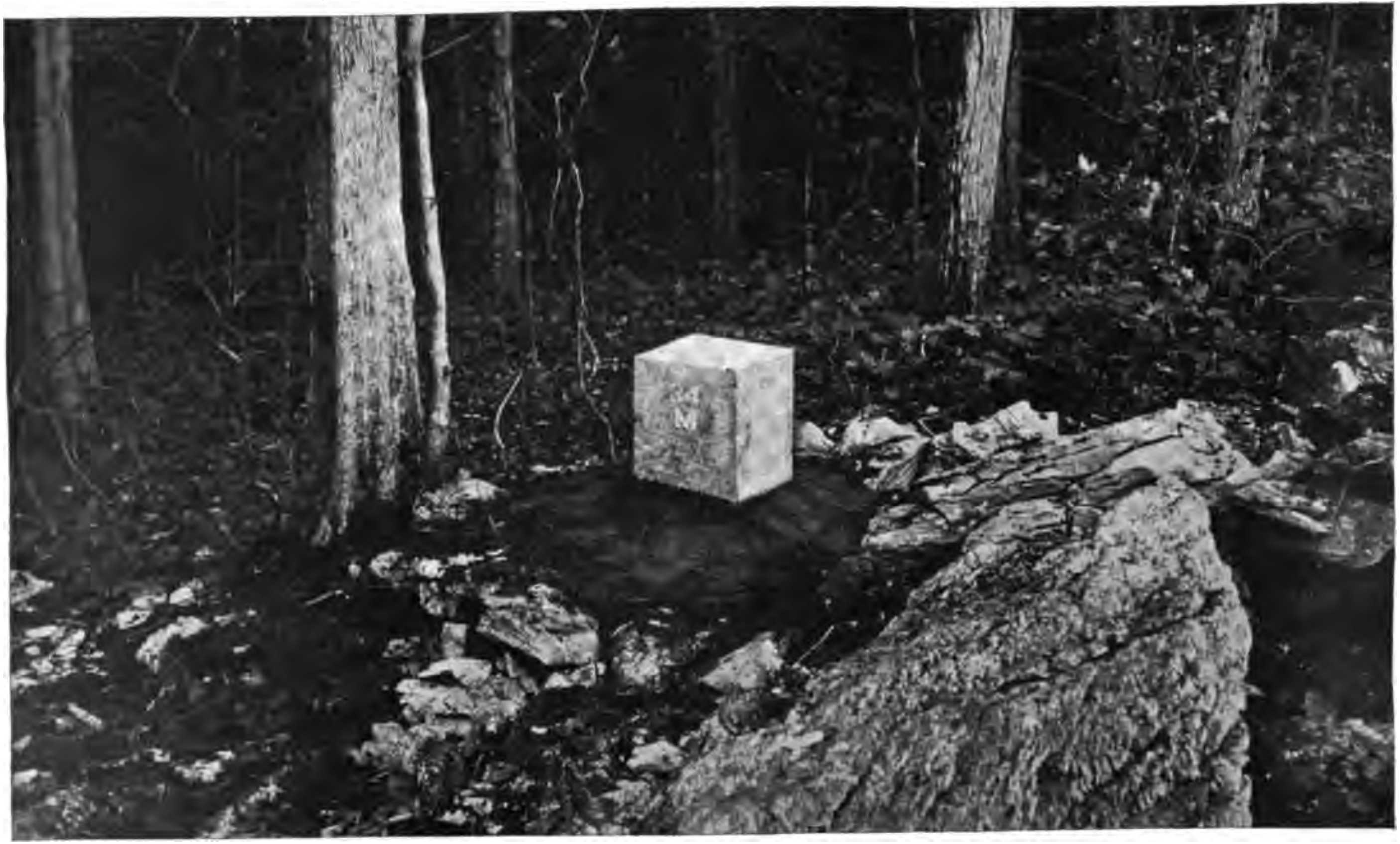
Number 79. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{32}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in wet clay, in cultivated land on the southerly slope of a mountain, 69 feet west of a wire fence.

Number 80. Granite post 5.5 feet in length; M. cut on the east face, N. Y. on the west face. It is set 1½ feet in loam and 2½ feet in excavation made in shale ledge, at about the highest point of a hill, wooded on the northerly slope and cultivated on its southerly slope.

Number 81. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{33}{\text{M.}}$ on the south face. It is set in excavation made 1 foot in loam and 3 feet in wet clay in cultivated land near the summit of a bare hill, about 900 feet north of the eastern terminus of a road leading to the John Griffin farm.

Number 82. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in wet clay, in a stone wall on the northerly slope of a bare rise, and on the southerly side of the Goodrich Hollow road.

Number 83. Granite post 5.1 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{34}{\text{M.}}$ on the south face. It is



Type of Mile Monument. New York and Mass. Boundary Line.

set in excavation made 1 foot in loam and 2 feet in flinty ledge, in woodland 5 feet west of a wall dividing cultivated land on the east from the woodland.

Number 84. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{35}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in gravel on the northerly slope of the most southerly of three bare mounds, and about 300 feet southeast of Mrs. B. H. Osgood's dwelling.

Number 85. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north and south faces. It is set in excavation made 5 feet in gravelly soil, in the wall on the northerly side of the Hancock-Stephentown road, on level, cultivated land about 1 mile west of the village of Hancock.

Number 86. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{36}{\text{M.}}$ on the south face. It is set in excavation made 4 feet in loam, in open pasture on the southerly slope of Rounds Mountain, 150 feet north of a clump of trees.

Number 87. Iron post; $\begin{matrix}\text{Mass.}\\ 1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\ \text{37 M.}\end{matrix}$ on the west face. It is set with its base resting on ledge 3 feet below the surface of the ground, on the westerly wooded slope of Rounds Mountain, about 50 feet northeast of the northeasterly corner of an open pasture.

Number 88. Granite post 8.9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 2 feet in loam and 3 feet in excavation made in shale ledge, in open pasture 15 feet east of a fence, at the highest points on Rounds Mountain on the State line.

Number 89. Iron post; Mass. 1898 cast on the east face, N. Y. on the west face. It is set with its base resting on the top of a flint rock about 2′ x 3′ x 3′ in size, placed in an excavation made 3 feet in loam and clay on the southerly slope of a mountain, in a small grove of maples, 275 feet south of a discontinued highway.

Number 90. Iron post; Mass. 1898 cast on the east face, N.Y. on the west face. It is set with its base resting on ledge on the steep northerly wooded slope of a mountain, 355 feet south of a wood road leading northeasterly to N. O. Rathbun's farm.

Number 91. Iron post; Mass. 1898 cast on the east face, N. Y. 40 M. on the west face. It is set with its base resting on the top of a rock placed in an excavation made 2½ feet in loam, on the northerly wooded slope of Whitmans Pinnacle, 725 feet north of open pasture.

Number 92. Iron post; Mass. 1898 cast on the east face, N. Y. on the west face. It is set with its base resting on the bottom of an excavation made 2 feet in ledge, in woodland at the highest point of Mount Misery on the State line.

Number 93. Iron post; Mass. 1898 cast on its east face N. Y. 41 M. on the west face. It is set with its base resting on ledge 2-3 of a foot below the surface of the ground, on the northerly wooded slope of Mount Misery, 300 feet north of the State line summit.

Number 94. Iron post; Mass. 1898 cast on the east face, N. Y. 42 M. on the west face. It is set with its base resting on shale ledge

1 foot below the surface of the ground, on the northerly wooded slope of the first high summit north of Mount Misery.

Number 95. A roughly dressed granite post 5.5 feet in length, 6 inches by 6 inches in section; N. Y. cut on the west face, W. on the north face, H. on the south face, 1898 cut diagonally across the top. It is set in cement in excavation made 1 foot in loam and 1 1-3 feet in ledge, on the northerly slope of a wooded peak, 2,000 feet south of the Sweet road.

Number 96. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 1 foot in loam, 2 feet in gravel and 3 feet in excavation made in shale ledge, in a wooded ravine on the northerly side of Sweet road, which is little better than a wood road and practically unused.

Number 97. Iron post, $\begin{matrix}\text{Mass.}\\1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\43\ \text{M.}\end{matrix}$ on the west face. It is set with its base resting on a rock placed at the bottom of an excavation made in loam on the northerly wooded slope of a mountain, 2,300 feet north of the Sweet road.

Number 98. Iron post; $\begin{matrix}\text{Mass.}\\1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\44\ \text{M.}\end{matrix}$ on the west face. It is set with its base resting on shale ledge 3 feet below the surface of the ground, on the northerly wooded slope of Rhodes Pinnacle.

Number 99. Granite post 9.5 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 1½ feet in loam and 3½ feet in excavation made in shale ledge on a grassy plot of land 50 feet south of the southerly intersection of Mills Hollow road with the State line.

Number 100. Iron post; $\begin{matrix}\text{Mass.}\\ 1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\ \text{45 M.}\end{matrix}$ on the west face. It is set with its base resting on shale ledge 3 feet below the surface of the ground on the southerly wooded slope of a mountain, 100 feet north of a narrow grassy plot, and 1,800 feet north of the most northerly intersection of the State line with Mills Hollow road.

Number 101. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the south face. It is set 3 feet in loam and 3 feet in excavation made in shale ledge on the westerly wooded slope of a mountain on the northerly side of Beebe Hollow road, which is not a public highway and is little traveled.

Number 102. Iron post; $\begin{matrix}\text{Mass.}\\ 1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\ \text{46 M.}\end{matrix}$ on the west face. It is set with its base resting on a masonry foundation 3½ feet below the surface of the ground, on the steep westerly wooded slope of a mountain, 700 feet north of Beebe Hollow road.

Number 103. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face. It is set 2½ feet in loam and 1½ feet in excavation made in ledge, on the easterly slope of Berlin Mountain, in grassy pasture, a short distance west of woodland, 250 feet easterly from and 40 feet below the summit of the mountain.

Number 104. Iron post; $\begin{matrix}\text{Mass.}\\ 1898\end{matrix}$ cast on the east face, $\begin{matrix}\text{N. Y.}\\ \text{47 M.}\end{matrix}$ on the west face. It is set with its base resting on a flat stone about 5 inches thick at the botom of an excavation made 2½ feet in loam, 3 feet east of the easterly side of a hemlock tree 9½ feet in circumstance, on the northerly wooded slope of Berlin Mountain.

Number 105. Granite post 8.8 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 1 foot in loam and 4 feet in excavation made in shale ledge, at the edge of woodland on the northerly side of the Berlin-Williamstown road.

Number 106. Iron post; $\genfrac{}{}{0pt}{}{\text{Mass.}}{1898}$ cast on the east face, $\genfrac{}{}{0pt}{}{\text{N. Y.}}{\text{48 M.}}$ on the west face. It is set with its base resting on shale ledge 1½ feet below the surface of the ground, on the steep southerly wooded slope of the mountain.

Number 107. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set 4 feet in rocky loam and 2½ feet in excavation made in shale ledge on the southerly side of the South Williamstown-Petersburg road, 1,000 feet east of its junction with the Williamstown-Petersburg road.

Number 108. Granite post 9 feet in length; Mass. cut on the east face, N. Y. on the west face, 1898 on the north face. It is set in excavation made 6 feet in shale ledge, on the northerly side of the Williamstown-Petersburg road, 1,200 feet east of its junction with the South Williamstown-Petersburg road.

Number 109. Iron post; $\genfrac{}{}{0pt}{}{\text{Mass.}}{1898}$ cast on the east face, $\genfrac{}{}{0pt}{}{\text{N. Y.}}{\text{49 M.}}$ on the west face. It is set with its base resting on a flint ledge 1½ feet below the surface of the ground, on the southerly slope of the southerly wooded summit of Jim Smith hill, 1,500 feet north of the Williamstown-Petersburg road.

Number 110. Granite post 5 feet in length; M. cut on the east face, N. Y. on the west face. It is set 1 foot in loam and 3 feet in excavation made in shale ledge, in open grassy pasture on the northerly brow of Jim Smith hill, about 25 feet north of the highest point of the hill on the State line.

Number 111. Granite post 5.5 feet in length; M. cut on the east face, N. Y. on the west face, $\overset{50}{\text{M.}}$ on the south face. It is set 3 feet in loam and 1 foot in excavation made in shale ledge on the northerly slope of a wooded hill, 125 feet south of a wood road.

Number 112. Granite post 8.5 feet in length, its top dressed 14 inches square. The lettered sides are dressed down 2 feet from the top, the northeast face and the remainder of the dressed faces being left rough except for a 1½ inch dressed margin for a distance of 4 feet down; Mass. 1896 cut on the southeast face, N. Y. 1898 on the southwest face, Vt. 1896 on the northwest face. It is set 2 feet in gravelly loam, and 3 feet in excavation made in shale ledge, on the easterly slope of a cultivated rise of land, about 75 feet west of a private roadway.

The following table contains a list of the monuments marking the boundary line, showing number, position and class of each:

No. of monument.	MARKING.	DISTANCE FROM CONN.—MASS.—N.Y.		CLASS.					REMARKS.
		Miles.	Feet.	9 ft. Granite.	5 ft. Granite.	5 ft. Iron.	3½ ft. Iron.	Drill Hole.	
1	Mt. Washington—Northeast—Salisbury corner (Conn.—Mass.—N. Y.)	0.00	0	1					Northwest corner of Conn. Triangulation station.
2	West side Ryan Bush road	0.12	609	1					
2A	Boundary summit	0.38	2,012						Iron pin of Hogeboom survey Triangulation station.
3	Ancram—Mt. Washington—Northeast corner	0.50	2,624	1					Southwest corner of Mass. Triangulation station.
4	First mile	1.00	5,280			1			
5	North side Roberts road	1.92	10,135	1					
6	Ancram—Copake—Mt. Washington corner	1.98	10,465	1					
7	Second mile	2.00	10,560		1				
8	Third mile	3.00	15,840		1				
9	Copake—Mt. Washington 1	3.08	16.273	1					"Angle on Alandar" Triangulation station.
10	Boundary summit, Bashbish Mountain	3.74	19,759			1			
11	Fourth mile	4.00	21,120			1			
12	Fifth mile	5.00	26,400			1			
13	North side Basbbish road	5.23	27,619	1					
14	Boundary summit, Cedar Mountain	5.72	30,195			1			
15	Sixth mile	6.00	31,680		1				
16	Boundary summit, Dugway Hill	6.54	34,528			1			
17	North side Mt. Washington—Hillsdale road	6.73	35,513	1					"North Mountain road."
18	Seventh mile	7.00	36,960		1				
19	Boundary summit, Mount Prospect	7.13	37,637			1			
19A	Mount Prospect (M.—N. Y.)	7.13	37,669					1	Triangulation station.
20	Copake—Egremont—Mt. Washington corner	8.00	42,231	1					
21	Eighth mile	8.00	42,240		1				
22	Boundary summit, Mount Fray	8.18	43,210			1			
22A	Mount Fray (M.—N. Y.)	8.19	43,244				1		Triangulation station.
23	Ninth mile	9.00	47,520		1				
24	North side Hillsdale—South Egremont road	9.28	48,979	1					
25	Copake—Egremont—Hillsdale corner	9.37	49,457	1					
26	Tenth mile	10.00	52,800		1				
27	North side Hillsdale—North Egremont road	10.53	55,586	1					
28	Eleventh mile	11.00	58,080		1				
29	South side North Egremont—North Hillsdale road	11.83	62,488	1					
30	Twelfth mile	12.00	63,360		1				
31	Alford—Egremont—Hillsdale corner	12.48	65,903	1					
32	North side White's Hill road	12.55	66,276	1					
33	Thirteenth mile	13.00	68,640			1			
34	South side Green River—North Egremont road	13.74	72,533	1					
35	Fourteenth mile	14.00	73,920		1				
36	North side Green River—Great Barrington road	14.44	76,225	1					
37	South side road	14.92	78,757	1					

No. of monument.	MARKING.	DISTANCE FROM CONN.—MASS.—N.Y.		CLASS.					REMARKS.
		Miles.	Feet.	9 ft. Granite.	5 ft. Granite.	5 ft. Iron.	3½ ft. Iron.	Drill Hole.	
38	Fifteenth mile	15 00	79,200		1				
38A	Mount	15 67	82,691				1		
39	Boundary summit mountain	15 67	82,727		1				
40	Sixteenth mile	16 00	84,480		1				
41	North side Alford–Green River road	16 28	85,974	1					
42	North side road	16 94	89,430	1					
43	Seventeenth mile	17 00	89,760		1				
44	Eighteenth mile	18 00	95,040			1			
45	Alford–Austerlitz–West Stockbridge corner	18 10	95,503	1					
46	Nineteenth mile	19 00	100,320			1			
46A	Mount Harvey (M. N. Y.)	19.30	101,8[illegible]				1		Triangulation station.
47	Boundary summit, Mount Harvey	19 30	101,910		1				
48	Twentieth mile	20 00	105,600			1			
49	South side Austerlitz–West Stockbridge South road	20 55	108,502	1					
50	South side road	20.61	108,820	1					
51	South side Austerlitz–West Stockbridge North road	20 99	110,8[illegible]	1					
52	Twenty first mile	21 00	110,880		1				
53	North side road	21 50	113,515	1					
54	South side Canaan–West Stockbridge road	21.96	115,924	1					At State Line hotel
55	Boston & Albany railroad	21.98	116,039		1				At State Line hotel.
	Twenty second mile	22 00	116,160		Unm'k'd.				15.5 feet south of bound No. 55.
56	North side Canaan–Richmond Furnace South road	22 01	116,205	1					
57	Canaan–Richmond–West Stockbridge corner	22 08	116,566	1					
58	South side Canaan–Richmond Furnace North road	[illegible]	12[illegible],130	1					
	Twenty third mile	23 00	121,440		Unm'k'd				9.8 feet north of bound No. 58.
59	East side Cunningham Hill road	23 15	122,250	1					
60	Boundary summit, Cunningham Hill	23 32	123,1[illegible]		1				
61	Twenty fourth mile	24 00	126,720		1				
62	South side Canaan–Richmond road	24 03	126,887	1					
63	West side road	24 56	129,[illegible]00	1					
64	South side Canaan–Pittsfield road	24 81	130,985	1					
65	Twenty fifth mile	25 00	132,000		1				
66	Twenty sixth mile	26 00	137,280		1				
67	Twenty seventh mile	27.00	142,500		1				
67A	Perry's Peak (M. N. Y.)	27 30	144,168				1		Triangulation station.
68	Canaan–Hancock–Richmond corner	27 36	144,459	1					
69	Twenty eighth mile	28 00	147,840		1				
70	South side Mt Lebanon–Pittsfield road	28 31	149,[illegible]						1818 post reset.
71	North side Mt Lebanon–Pittsfield road	28.35	149,712	1					
72	North side State Highway	28.98	153,036	1					
73	Twenty ninth mile	29.00	153,120		1				
74	Boundary summit, Mount Lebanon	29 63	156,445		1				
74A	Mount Lebanon	29 63	156,445				1		Trigonometric level bench.
75	Thirtieth mile	30 00	158,400		1				

76	Thirty-first mile	31.00	163,680		1				
77	North side Old Lebanon Springs—Pittsfield road,	31.05	163,936	1					
78	South side Lebanon Springs—Pittsfield road	31.26	165,044	1					
79	Thirty-second mile	32.00	168,960		1				
79A	Clover	32.18	169,924				1		Trigonometric level bench.
80	Boundary summit, Clover	32.19	169,956		1				
81	Thirty-third mile	33.00	174,240		1				
82	South side Goodrich Hollow road	33.48	176,795	1					
83	Thirty-fourth mile	34.00	179,520		1				
84	Thirty-fifth mile	35.00	184,800		1				
85	North side Hancock—Stephentown road	35.31	187,489	1					
86	Thirty-sixth mile	36.00	190,080		1				
87	Thirty-seventh mile	37.00	195,360			1			
87A	Round's Mountain (M.—N. Y.)	37.39	197,412				1		Triangulation station.
88	Boundary summit, Round's Mountain	37.39	197,425	1					
89	Thirty-eighth mile	38.00	200,640			1			
90	Thirty-ninth mile	39.00	205,920			1			
90A	Whitman's Pinnacle	39.81	210,372				1		
91	Fortieth mile	40.00	211,200			1			
92	Mount Misery (M.—N. Y.)	40.94	216,174			1			Triangulation station.
93	Forty-first mile	41.00	216,480			1			
94	Forty-second mile	42.00	221,760			1			
95	Berlin—Hancock—Williamstown corner	42.18	222,732						1896 bound reset in cement.
96	North side Sweet road	42.56	224,743	1					
97	Forty-third mile	43.00	227,040			1			
97A	Rhode's Pinnacle	43.83	231,396				1		Trigonometric level bench.
98	Forty-fourth mile	44.00	232,320			1			
99	South side Mills Hollow road	44.39	234,376	1					
100	Forty-fifth mile	45.00	237,600			1			
101	North side Beebe Hollow road	45.87	242,202	1					
102	Forty-sixth mile	46.00	242,880			1			
103	Boundary summit, Berlin Mountain	46.41	245,050		1				
103A	Berlin Mountain (M.—N. Y.)	46.41	245,070				1		Triangulation station.
104	Forty-seventh mile	47.00	248,160			1			
105	North side Berlin—Williamstown road	47.32	249,795	1					
106	Forty-eighth mile	48.00	253,440			1			
107	South side South Williamstown—Petersburg road	48.65	256,903	1					
108	North side Williamstown—Petersburg road	48.71	257,210	1					
109	Forty-ninth mile	49.00	258,720			1			
109A	Boundary summit	49.01	258,771				1		Near 1787 16th transit post.
109B	Jim Smith Hill (M.—N. Y.)	49.59	261,820				1		Triangulation station.
110	Boundary summit, Jim Smith Hill	49.59	261,847		1				
111	Fiftieth mile	50.00	264,000		1				
	Petersburg—Pownal Williamstown corner	50.29	265,519						1896 bound reset. Triangulation station.
	Totals			47	36	26	12	1	
	On summits			1	7	6	12		
	At mile points				28	20			
	At road crossings			36					+ 1 Old bound reset.
	At three town corners			9					+ 2 Old bounds reset.
	At railroad crossings				1				
	At angle			1					

In conclusion we wish to express our thanks to Prof. A. D. Butterfield and Mr. G. L. Hosmer, who had charge respectively of the chaining and long alignment of a greater portion of the line, for their untiring interest in the work; also to the other members of the party for the willingness they invariably showed in carrying out their respective duties.

. Very respectfully,

CHARLES H. FLANIGAN,
Assistant Engineer New York State.

EUGENE E. PEIRCE,
Assistant Engineer Massachusetts State Survey.

Description of the boundary line between the State of New York and the Commonwealth of Massachusetts, as surveyed and marked in 1897, 1898 and 1899 under the direction of the State Engineer and Surveyor representing New York, and the Topographical Survey Commission representing Massachusetts, acting under the authority of chapter 678 of the Laws of 1892 of the State of New York and chapter 25 of the resolves of 1897 of the Commonwealth of Massachusetts, and filed in the State archives together with the five following plans entitled:

1. Record Plan and Profile.
2. Study Plan and Profile.
3. Profile showing the lines of sight.
4. Plan of Triangulation System.
5. Details at "State Line" village.

DESCRIPTION.

Beginning at post 1, a granite monument set in shale ledge on the side of a wooded mountain peak 609 feet east of the Ryan Bush road, in latitude 42° 02′ 58″.427 north and longitude

73° 29′ 15″.959 west from Greenwich, and marking the northwest corner of Connecticut, a corner of the commonwealth of Massachusetts, and a corner of the State of New York; thence on an azimith of 90° 43′ 49″, 2,624 feet to post 3, a granite monument set in shale ledge on the steep westerly slope of a wooded mountain in latitude 42° 02′ 58″.756 and longitude 73° 29′ 50.737″, at a corner of the towns of Mount Washington, Massachusetts, and Ancram and Northeast, New York; thence on an azimith of 167° 08′ 15″, 13,649 feet to post 9, a granite monument set in ledge on the westerly wooded slope of Alandar mountain about ¼ mile west of its summit, in latitude 42° 05′ 10″.205 and longitude 73° 30′ 31″.031, at the corner of Mount Washington, Massachusetts and Copake, New York; thence on an azimith of 195° 12′ 22″, 249,246 feet by the towns of Mount Washington, Egremont, Alford, West Stockbridge, Richmond, Hancock and Williamstown, Massachusetts, and Copake, Hillsdale, Austerlitz, Canaan, New Lebanon, Stephentown, Berlin and Petersburg, New York, to post 112, a granite monument set in shale ledge and earth on an open easterly slope about 75 feet west of a private roadway in latitude 42° 44′ 45″.201 and longitude 73° 15′ 54″.904, at the northwest corner of Massachusetts, also in the east line of New York and in the south line of Vermont, and marking a point in the boundaries of the towns of Williamstown in Massachusetts, Petersburg in New York, and Pownal in Vermont.

The term "azimith" as used in this description is the angle which a line makes at its point of beginning with the true meridian, reckoning from the south point as zero around by the west.

The following tables show the positions of the foregoing monuments together with the intermediate posts at road crossings, railroads, town corners, summits and mile points excepting the 22nd and 23rd miles, which are unmarked. The distances given are from the northwest corner of Connecticut.

TABLE SHOWING THE POSITIONS OF THE BOUNDARY MARKS ON THE NEW YORK-MASSACHUSETTS BOUNDARY LINE.

From the Northwest Corner of Connecticut to the Southwest Corner of Massachusetts.

		Kind of post.		Distances, feet.
Post	1	A	Mt. Washington-Northeast-Salisbury corner	0
Post	2	A	West side Ryan Bush road	609
Post	3	A	Ancram-Mount Washington Northeast corner	2,624

From the Southwest Corner of Massachusetts to the Angle on Alandar Mountain.

Post	4	C	First mile	5,280
Post	5	A	North side Roberts road	10,135
Post	6	A	Ancram-Copake-Mount Washington corner	10,465
Post	7	B	Second mile	10,560
Post	8	B	Third mile	15,840
Post	9	A	Copake-Mount Washington corner (*Alandar Mountain*)	16,273

From Angle on Alandar Mountain to the Northwest Corner of Massachusetts.

Post	10	C	Boundary summit, Bashbish mountain	19,759
Post	11	C	Fourth mile	21,120
Post	12	C	Fifth mile	26,400
Post	13	A	North side Bashbish road	27,619

		Kind of post.		Distances, feet.
Post	14	C	Boundary summit, Cedar mountain.....	30,195
Post	15	B	Sixth mile	31,680
Post	16	C	Boundary summit, Dugway Hill........	34,528
Post	17	A	North side Mount Washington-Hillsdale road	35,513
Post	18	B	Seventh mile	36,960
Post	19	C	Boundary summit, *Mount Prospect*......	37,637
Post	20	A	Copake-Egremont-Mt.Washington corner	42,231
Post	21	B	Eighth mile	42,240
Post	22	C	Boundary summit, *Mount Fray*.........	43,210
Post	23	B	Ninth mile (number omitted)...........	47,520
Post	24	A	North side Hillsdale-South Egremont road	48,979
Post	25	A	Copake-Egremont-Hillsdale corner......	49,457
Post	26	B	Tenth mile	52,800
Post	27	A	North side Hillsdale-North Egremont road	55,586
Post	28	B	Eleventh mile (number omitted)........	58,080
Post	29	A	South side No. Egremont-No. Hillsdale road	62,488
Post	30	B	Twelfth mile	63,360
Post	31	A	Alford-Egremont-Hillsdale corner	65,903
Post	32	A	North side Whites Hill road...........	66,276
Post	33	C	Thirteenth mile	68,640
Post	34	A	South side Green River-No. Egremont road	72,533
Post	35	B	Fourteenth mile	73,920
Post	36	A	North side Green River-Great Barrington road	76,225

		Kind of post.		Distances, feet.
Post	37	A	South side road	78,757
Post	38	B	Fifteenth mile	79,200
Post	39	B	Boundary summit mountain	82,727
Post	40	B	Sixteenth mile	84,480
Post	41	A	North side Alford-Green River road	85,974
Post	42	A	North side road	89,430
Post	43	B	Seventeenth mile	89,760
Post	44	C	Eighteenth mile	95,040
Post	45	A	Alford-Austerlitz-West Stockbridge corner	95,593
Post	46	C	Nineteenth mile	100,320
Post	47	B	Boundary summit, *Mount Harvey*	101,910
Post	48	C	Twentieth mile	105,600
Post	49	A	South side Austerlitz-W. Stockbridge So. road	108,502
Post	50	A	South side road	108,829
Post	51	A	South side Austerlitz-W. Stockbridge No. road	110,837
Post	52	B	Twenty-first mile	110,880
Post	53	A	North side road	113,515
Post	54	A	South side Canaan-West Stockbridge road	115,924
Post	55	B	Boston and Albany Railroad	116,039
Post	56	A	North side Canaan-Richmond Furnace South road	116,205
Post	57	A	Canaan-Richmond-West Stockbridge corner	116,596
Post	58	A	South side Canaan-Richmond Furnace North road	121,430
Post	59	A	East side Cunningham Hill road	122,250

		Kind of post.		Distances, feet.
Post	60	B	Boundary summit, *Cunningham Hill*	123,147
Post	61	B	Twenty-fourth mile	126,720
Post	62	A	South side Canaan-Richmond road	126,887
Post	63	A	West side road	129,700
Post	64	A	South side Canaan-Pittsfield road	130,985
Post	65	B	Twenty-fifth mile	132,000
Post	66	B	Twenty-sixth mile	137,280
Post	67	B	Twenty-seventh mile	142,560
Post	68	A	Canaan-Hancock-Richmond corner	144,459
			(*Perrys Peak.*)	
Post	69	B	Twenty-eighth mile	147,840
Post	70	§	South side Mt. Lebanon-Pittsfield road	149,632
Post	71	A	North side Mt. Lebanon-Pittsfield road	149,712
Post	72	A	North side State Highway	153,036
Post	73	B	Twenty-ninth mile	153,120
Post	74	B	Boundary summit, *Mount Lebanon*	156,435
Post	75	B	Thirtieth mile	158,400
Post	76	B	Thirty-first mile	163,680
Post	77	A	North side old Lebanon Springs-Pittsfield road	163,936
Post	78	A	South side Lebanon Springs-Pittsfield road	165,044
Post	79	B	Thirty-second mile	168,960
Post	80	B	Boundary summit, *Clover*	169,956
Post	81	B	Thirty-third mile	174,240
Post	82	A	South side Goodrich Hollow road	176,795
Post	83	B	Thirty-fourth mile	179,520
Post	84	B	Thirty-fifth mile	184,800

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§ Old 1818 post reset.

		Kind of post.		Distances, feet.
Post	85	A	North side Hancock-Stephentown road	187,489
Post	86	B	Thirty-sixth mile	190,080
Post	87	C	Thirty-seventh mile	195.360
Post	88	A	Boundary summit, *Rounds Mountain*	197,425
Post	89	C	Thirty-eighth mile (number omitted)	200.640
Post	90	C	Thirty-ninth mile (number omitted)	205,920
Post	91	C	Fortieth mile	211,200
Post	92	C	Boundary summit, *Mount Misery* (*M-N. Y.*)	216,174
Post	93	C	Forty-first mile	216,480
Post	94	C	Forty-second mile	221,760
Post	95	*	Berlin-Hancock-Williamstown corner	222,732
Post	96	A	North side Sweet road	224,743
Post	97	C	Forty-third mile	227,040
Post	98	C	Forty-fourth mile, north slope of Rhodes Pinnacle	232.320
Post	99	A	South side, Mills Hollow road	234,376
Post	100	C	Forty-fifth mile	237,600
Post	101	A	North side Beebe Hollow road	242.202
Post	102	C	Forty-sixth mile	242,880
Post	103	B	Boundary summit, *Berlin Mountain*	245,050
Post	104	C	Forty-seventh mile	248,160
Post	105	A	North side Berlin-Williamstown road	249.795
Post	106	C	Forty-eighth mile	253,440
Post	107	A	South side So. Williamstown-Petersburg road	256,903
Post	108	A	North side Williamstown-Petersburg road	257,210
Post	109	C	Forty-ninth mile	258,720

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* Old town corner stone reset.

	Kind of post.		Distances, feet.
Post 110	B	Boundary summit, Jim Smith Hill......	261,847
Post 111	B	Fiftieth mile..........................	264,000
Post 112	¶	Petersburg-Pownal-Williamstown corner at the northwest corner of Massachusetts..............................	265,519

*The monuments marking the line are of the three following classes:

Class A. Light colored granite 12″ x 12″ x 9′ long, dressed 3 feet from the top, lettered "Mass." and "N. Y." on opposite sides and "1898" on the third side. These bounds are used at road crossings and town corners.

Class B. Leetes Island granite 12″ x 12″ x 5′, dressed on top and 1 foot down, lettered "M" and "N. Y." These bounds are used at mile points and on a few summits.

Class C. Cast iron posts, averaging 4″ in diameter and 5 feet long, bolted to the ledge. The head elliptical and lettered Mass. 1898 and "N. Y." and when used for mile points the number of the mile is added. These posts mark summits and mile points where stone bounds could not be set.

The foregoing description, having been carefully examined and fully considered, is approved, adopted, and filed by us.

EDWARD A. BOND.
State Engineer and Surveyor for New York.

DESMOND FITZ GERALD,
ALFRED E. BURTON,
FRANK W. HODGDON.
Topographical Survey Commissioners for Massachusetts.

¶ 1896 post marking the Vermont line re-set by consent of authorities of each State.

It is intended at the coming session of the Legislature to introduce the following:

AN ACT TO AMEND THE STATE LAW, IN RELATION TO THE BOUNDARY LINE BETWEEN THE STATE OF NEW YORK AND THE COMMONWEALTH OF MASSACHUSETTS.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. Section 3, of chapter 678 of the laws of 1892, entitled "An act in relation to the sovereignty, boundaries, survey, great seal and arms of the state and constituting chapter 2 of the general laws," is hereby amended so as to read as follows:

§ 3. Massachusetts boundary line.—The boundary line between the state of New York and the commonwealth of Massachusetts from the northwest corner of Connecticut to the southerly line of Vermont shall be and hereby is fixed as follows, to wit: Beginning at post 1, a granite monument set in ledge on the side of a wooded mountain peak 609 feet east of Ryan Bush road, in latitude 42° 02′ 58″.427 north, and longitude 73° 29′ 15″.959 west from Greenwich, and marking the northwest corner of Connecticut, a corner of the commonwealth of Massachusetts, and a corner of the state of New York; thence on an azimuth of 90° 43′ 49″, 2,624 feet to post 3, a granite monument set in ledge on the steep westerly slope of a wooded mountain in latitude 42° 02′ 58″.756 and longitude 73° 29′ 50″.737, at a corner of the towns of Mount Washington, Massachusetts, and Ancram and Northeast, New York; thence on an azimuth of 167° 08′ 15″, 13,649 feet to post 9, a granite monument set in ledge on the westerly wooded slope of Alandar mountain about one-quarter mile west of its summit, in latitude 42° 05′ 10″.205 and longitude 73° 30′ 31″.031, at the corner of Mount Washington, Massachusetts, and Copake, New York; thence on an azimuth of 195° 12′ 22″, 249,246 feet, by the towns of Mount Washington, Egremont, Alford, West Stockbridge, Richmond, Hancock and Williamstown, Massachusetts, and Copake, Hillsdale, Austerlitz, Canaan, New Lebanon, Stephentown, Berlin and Petersburg, New York to post 112, a granite monument set in ledge and earth on an open easterly slope about 75 feet west of a private roadway in latitude 42° 44′ 45″.201 and longitude 73° 15′ 54″.904 at the northwest corner of Massachusetts; also in the east line of New York and in the south line of Vermont, and marking a point in the boundaries of the towns of Williamstown in Massachusetts, Petersburg in New York and Pownal in Vermont. The term "azimuth" as used in this description is the angle which a line makes at its point of beginning with the true meridian, reckoning from the south point as zero around by the west. In addition to the monuments at the ends of the above mentioned straight lines, other monuments have been set at the points of intersection of the above described straight lines with highways, railroads, and boundary lines of three towns in New York and seven towns in Massachusetts; also at mile points excepting the 22d and 23d miles which are unmarked. These additional marks are described as follows: Beginning at the said northwest corner of Connecticut; thence westerly about 609 feet to a monument on the west side of Ryan Bush road; thence westerly about 2,015 feet to post 3, previously described; thence northwesterly about 2,656 feet to a monument marking the first mile point; thence northwesterly about 4,855 feet to a monument on the north side of the Roberts road; thence northwesterly about 330 feet to a monument at the corner of Ancram, Copake and Mount Washington; thence northwesterly about 95 feet to a monument marking the second mile point; thence northwesterly about 5,280 feet to a monument marking the third mile point; thence northwesterly about 433 feet to post 9, previously described; thence northerly about 3,486 feet to a monument at the boundary summit of the Bashbish mountain; thence northerly about 1,361 feet to a monument marking the fourth mile point; thence northerly about 5,280 feet to a monument marking the fifth mile point; thence northerly about 1,219 feet to a monument on the north side of the Bashbish road; thence northerly about 2,576 feet to a monument at the boundary summit of Cedar mountain; thence northerly about 1,485 feet to a monument marking the sixth mile point; thence northerly about 2,848 feet to a monument at the boundary summit of Dugway Hill; thence northerly about 985 feet to a monument on the north side of the Mount Washington-Hillsdale road; thence northerly about 1,447 feet to a monument marking the seventh mile point; thence northerly about 677 feet to a monument at the boundary summit of Mount Prospect; thence northerly about 4,594 feet to a monument at the corner of Copake, Egremont and Mount Washington; thence northerly about 9 feet to a monument marking the eighth mile point; thence northerly about 970 feet to a monument at the boundary summit of Mount Fray; thence northerly about 4,310 feet to a monument marking the ninth mile point; thence northerly about 1,459 feet to a monument on the north side of the Hillsdale-South Egremont road; thence northerly about 476 feet to a monument at the corner of Copake, Egremont and Hillsdale; thence northerly about 3,343 feet to a monument marking the tenth mile point; thence northerly about 2,786 feet to a monument on the north side of the Hillsdale-North Egremont road; thence northerly about 2,494 feet to a monument marking the eleventh mile point; thence northerly about 4,408 feet to a monument on the south side of the North Egremont-North Hillsdale road; thence northerly about 872 feet to a monument marking the twelfth mile point; thence northerly about 2,543 feet to a monument at the corner of Alford, Egremont and Hillsdale; thence northerly about 373 feet to a monument on the north side of Whites Hill road; thence northerly about 2,364 feet to a monument marking the thirteenth mile point; thence northerly about 3,893 feet to a monument on the south side of the Green River-North Egremont road; thence northerly about 1,387 feet to a monument marking the fourteenth mile point; thence northerly about 2,305 feet to a monument on the north side of the Green River-Great Barrington road; thence northerly about 2,532 feet to a monument on the south side of a road; thence northerly about 443 feet to a monument marking the fifteenth mile point; thence northerly about 3,527 feet to a monument at a boundary summit; thence northerly about 1,753 feet to a monument marking the sixteenth mile point; thence northerly about 1,494 feet to a monument on the north side of the Alford-Green River road; thence northerly about 3,456 feet to a monument on the north side of a road; thence northerly about 330 feet to a monument marking the seventeenth mile point; thence northerly about 5,280 feet to a monument marking the eighteenth mile point; thence northerly about 553 feet to a monument at the corner of Alford, Austerlitz and West Stockbridge; thence northerly about 4,727 feet to a monument marking the nineteenth mile point; thence northerly about 1,590 feet to a monument at the boundary summit of Mount Harvey; thence northerly about 3,690 feet to a monument marking the twentieth mile point; thence northerly about 2,902 feet to a monument on the south side of the Austerlitz-West Stockbridge South road; thence northerly about 327 feet to a monument on the souh side of a road; thence northerly about 2,008 feet to a monument on the south side of the Austerlitz-West Stockbridge North road; thence northerly about 43 feet to a monument marking the twenty-first mile point; thence northerly about 2,635 feet to a monument on the north side of a road; thence northerly about 2,409 feet to a monument on the south side of the Canaan-West Stockbridge road; thence northerly about 115 feet to a monument on the Boston and Albany railroad; thence northerly about 166 feet to a monument on the north side of the Canaan-Richmond Furnace South road; thence northerly about 391 feet to a monument at the corner of Canaan, Richmond and West Stockbridge; thence northerly about 4,834 feet to a monument on the south side of the Canaan-Richmond Furnace North road; thence northerly about 820 feet to a monument on the east side of the Cunningham Hill road; thence northerly about 897 feet to a monument at the boundary summit of Cunningham Hill; thence northerly about 3,573 feet to a monument marking the twenty-fourth mile point; thence northerly about 167 feet to a monument on the south side of the Canaan-Richmond road; thence northerly about 2,813 feet to a monument on the west side of a road; thence northerly about 1,285 feet to a monument on the south side of the Canaan-Pittsfield road; thence northerly about 1,015 feet to a monument marking the twenty-fifth mile point; thence northerly about 5,280 feet to a monument marking the twenty-sixth mile point; thence northerly about 5,280 feet to a monument marking the twenty-seventh mile point; thence northerly about 1,899 feet to a monument at the corner of Canaan, Richmond and Hancock; thence northerly about 3,381 feet to a monument marking the twenty-eighth mile point; thence northerly about 1,792 feet to a monument on the south side of the Mount Lebanon-Pittsfield road; thence northerly about 80 feet to a monument on the north side of the Mount Lebanon-Pittsfield road; thence northerly about 3,324 feet to a monument on the north side of the state highway between Pittsfield and New Lebanon; thence northerly about 84 feet to a monument marking the twenty-ninth mile point; thence northerly about 3,315 feet to a monument at the boundary summit of Mount Lebanon; thence northerly about 1,965 feet to a monument marking the thirtieth mile point; thence northerly about 5,280 feet to a monument marking the thirty-first mile point; thence northerly about 256 feet to a monument on the north side of the old Lebanon Springs-Pittsfield road; thence northerly about 1,108 feet to a monument on the south side of the Lebanon Springs-Pittsfield road; thence northerly about 3,916 feet to a monument marking the thirty-second mile point; thence northerly about 996 feet to a monument at the boundary summit of Clover; thence northerly about 4,284 feet to a monument marking the thirty-third mile point; thence northerly about 2,555 feet to a monument on the south side of the Goodrich Hollow road; thence northerly about 2,725 feet to a monument marking the thirty-fourth mile point; thence northerly about 5,280 feet to a monument marking the thirty-fifth mile point; thence northerly about 2,689 feet to a monument on the north side of the Hancock-Stephentown road; thence northerly about 2,591 feet to a monument marking the thirty-sixth mile point; thence northerly about 5,280 feet to a monument marking the thirty-seventh mile point; thence northerly about 2,065 feet to a monument at the boundary summit of Bounds Mountain; thence northerly about 3,215 feet to a monument marking the thirty-eighth mile point; thence northerly about 5,280 feet to a monument marking the thirty-ninth mile point; thence northerly about 5,280 feet to a monument marking the fortieth mile point; thence northerly about 4,974 feet to a monument marking the triangulation station on Mount Misery; thence northerly about 306 feet to a monument marking the forty-first mile point; thence northerly about 5,280 feet to a monument marking the forty-second mile point; thence northerly about 972 feet to a monument at the corner of Berlin, Hancock and Williamstown; thence northerly about 2,011 feet to a monument on the north side of the Sweet road; thence northerly about 2,297 feet to a monument marking the forty-third mile point; thence northerly about 5,280 feet to a monument marking the forty-fourth mile point; thence northerly about 2,056 feet to a monument on the south side of the Mills Hollow road; thence northerly about 3,224 feet to a monument marking the forty-fifth mile point; thence northerly about 4,602 feet to a monument on the north side of the Beebe Hollow road; thence northerly about 678 feet to a monument marking the forty-sixth mile point; thence northerly about 2,170 feet to a monument at the boundary summit of Berlin Mountain; thence northerly about 3,110 feet to a monument marking the forty-seventh mile point; thence northerly about 1,635 feet to a monument on the north side of the Berlin-Williamstown road; thence northerly 3,645 feet to a monument marking the forty-eighth mile point; thence northerly about 3,463 feet to a monument on the south side of the South Williamstown-Petersburg road; thence northerly about 307 feet to a monument on the north side of the Williamstown-Petersburg road; thence northerly about 1,510 feet to a monument marking the forty-ninth mile point; thence northerly about 3,127 feet to a monument at the boundary summit of Jim Smith Hill; thence northerly about 2,153 feet to a monument marking the fiftieth mile point; thence northely about 1,519 feet to post 112 previously described; thereby including within the state of New York that portion of the former territory of Massachusetts known as the district of Boston corner, situate formerly in the southwesterly corner of Massachusetts, and westerly of the southwest line of the town of Mount Washington, in the county of Berkshire, and ceded to the state of New York upon certain conditions by an act of the legislature of Massachusetts passed in May 14, 1853, entitled "An act relating to the separation of the district of Boston corner from this commonwealth, and the cession of the same to the state of New York." The acceptance by this state of sovereignty and jurisdiction of such ceded territory which took effect January 3, 1855, the date of the approval of the act of congress consenting to such cession is continued in force, subject to the retention by the state of Massachusetts of jurisdiction in any cause which arose or was pending before the date of the issuing of the proclamation provided in the third section of such act of the legislature of Massachusetts.

§2. This act shall take effect immediately.

Description of the Location of the Monuments Marking the Boundary Line Between the Counties of Lewis and Herkimer.

INITIAL MONUMENT.

This monument, which marks the southeast corner of the county of Lewis and the northeast corner of the county of Oneida, stands on level ground on the second low hill north of Moose river, about 1,600 feet north of the right-hand bank of the river. It is an ordinary field boulder, 3 feet long and 2 feet wide, having one-half inch drill hole in the center of the top; through this drill hole grooves extend in the direction of the Oneida-Herkimer line and the Lewis-Herkimer line and the Oneida-Lewis line. The initial letters of the names of the three counties which corner at this point are cut in their proper places on the boulder.

MONUMENT No. 1.

Post No. 1, .56 miles from the corner. It is on a hardwood knoll, rising to the east and, sloping off to the west. The monument stands in a soil of sandy loam, 75 feet south of a wedge-shaped rock, and is surrounded by a pile of boulders.

At the monument the following bearings and distances were taken: N. 45° E. 9.5 feet to a 15-inch maple; S. 25° E. 18.3 feet to a 10-inch beech; S. 45° W. 12.5 feet to an 8-inch spruce, and S. 85° W. 6.5 feet to a 12-inch hemlock.

MONUMENT No. 2.

Post No. 2, 1 mile from the corner. It is on a level clear beech flat, near a tall 4-foot birch, and about half a mile south of a windfall.

At the monument the following bearings and distances were taken: N. 10° E. 22.3 feet to a 12-inch spruce; S. 10° E. 6.3 feet to a 10-inch beech; N. 55° W. 8.9 feet to a 6-inch beech, and No. 85° W. 17.9 to a 11-inch beech.

MONUMENT No. 3.

Post No. 3, 1.37 miles from the corner. It stands 200 feet south of a windfall in hardwood timber. The ground is nearly level on the east, south and west, but on the north it slopes to a small stream.

At the monument the following bearings and distances were taken: N. 75° E. 23.3 feet to a 16-inch beech; S. 45° W. 13.9 feet to a 12-inch beech, and N. 85° W. 18.3 feet to a 12-inch beech.

MONUMENT No. 4.

Post No. 4, 2.04 miles from the corner. The monument stands in a level stretch of rather dense spruce and beech timber, and is about 400 feet south of the Brown Tract road.

At the monument the following bearings and distances were taken: S. 30° E. 11.8 feet to a 12-inch maple; S. 15° E. 7.2 feet to a 6-inch beech, and S. 40° W. 15.9 feet to a 14-inch birch.

MONUMENT No. 5.

Post No. 5, 2.09 miles from the corner. The monument stands just north of the Brown Tract road, on level ground in second-growth timber; just west of the monument the ground slopes to the westward.

At the monument the following bearings and distances were taken: S. 70° W. 9.6 feet to a 5-inch birch; N. 35° W. 9.4 feet to a 6-inch cherry; N. 10° W. 11.4 feet to a small cherry.

MONUMENT No. 6.

Post No. 6, 2.52 miles from the corner. It stands in an opening of light beech timber, 75 feet south of old wooden track railroad; 35 feet to the southwest is a large rock. On the north the ground is level to the track, on the south it runs level for about 40 feet, then rises to a summit of small knoll, and on the east it rises, and slopes downward on the west.

At the monument the following bearings and distances were taken: S. 20° E. 18 feet to a 12-inch beech; S. 45° W. 24.3 feet to a 30-inch birch, and N. 15° W. 22.4 feet to a 6-inch spruce.

MONUMENT No. 7.

Post No. 7, 3.01 miles from the corner. It stands in a hardwood forest near a group of birch trees. The ground rises to the northward slopes downward to the south end; is about level east and west.

At the monument the following bearings and distances were taken: N. 15° E. 19.4 feet to a 10-inch spruce; S. 20° E. 9.3 feet to a 16-inch birch, and N. 40° W. 11.4 feet to a 10-inch spruce.

MONUMENT No. 8.

Post No. 8, 3.3 miles from the corner. It stands 30 feet south of the Abbey road, 30 feet west of a large rock, 6 feet high; it stands in a forest of beech and birch; the ground slopes downward on the east and south and rises to the north and west. It is approximately a quarter of a mile west of Dice's lumber camp.

At the monument the following bearings and distances were taken: N. 30° E. 11.7 feet to a 12-inch beech; S. 75° E. 20.9 feet to a 12-inch beech, and N. 45° W. 16.7 feet to a 16-inch birch.

MONUMENT No. 9.

Post No. 9, 3.52 miles from the corner. It stands on a knoll of heavy spruce timber, about 200 feet south of a long tamarac swamp. The ground slopes gently downward on the west and south, but on the north has a steeper slope; on the east it rises to a small knoll and then down to a swamp. There is no hardwood timber within 800 feet of the monument.

At the monument the following bearings and distances were taken: N. 55° E. 7.3 feet to a 5-inch hemlock; S. 20° E. 17.8 feet to a 6-inch balsam; S. 45° W. 9.5 feet to a 14-inch soft maple.

MONUMENT No. 10.

Post No. 10, 3.92 miles from the corner. The monument stands on the summit of a hill near a clump of soft maples, which are on a birch ridge running northeast by southwest. The surrounding timber is of beech and birch.

At the monument the following bearings and distances were taken: N. 85° E. 13.2 feet to a 14-inch birch; S. 45° W. 4.8 feet to a 4-inch beech, and N. 60° W. 9 feet to a 12-inch hemlock.

MONUMENT No. 11.

Post No. 11, 4.56 miles from the corner. It is situated to the northwest of a round-topped knoll and in a thick second growth of spruce and beech. It is 800 feet north of Doe Pond mountain and approximately 1½ miles east of Copper lake.

At the monument the following bearings and distances were taken: N. 20° E. 8.5 feet to an 8-inch spruce; S. 40° W. 8.5 feet to a 2-inch birch; N. 10° W. 15 feet to a 6-inch spruce.

MONUMENT No. 12.

Post No. 12, 5.097 miles from the corner. Stands on a level ridge of beech and birch timber, about one-half mile south of Middle Branch creek. The monument is 10 feet south of a small boulder; the ground is level for a short distance about the monument.

At the monument the following bearings and distances were taken: N. 85° E. 8.5 feet to an 8-inch dogwood; S. 15° W. 13.6 feet to a beech; N. 85° W. 14.2 feet to a 4-inch beech.

MONUMENT No. 13.

Post No. 13, 5.51 miles from the corner. It stands 700 feet north of Middle Branch creek and 20 feet north of the south edge of a flat. It is in a thick, clear forest. The ground slopes gently to the west. Middle Settlement lake is about 1 mile to east.

At the monument the following bearings and distances were taken: N. 45° E. 15.7 feet to a 12-inch beech; S. 10° E. 4.9 feet to a 12-inch spruce; S. 90° W. 17.4 feet to an 8-inch spruce.

MONUMENT No. 14.

Post No. 14, 5.99 miles from the corner. It stands on the north side of the second high summit south of Otter lake. It is about 500 feet south of said summit, the side of which is covered with small hardwood brush. The ground rises to the east and south and slopes downward on the north and west; about 200 feet in the latter direction is a small stream flowing through a swamp.

At the monument the following bearings and distances were taken: N. 65° E. 16.4 feet to a 5-inch beech; S. 70° E. 3.9 feet to a 5-inch birch, and N. 40° W. 18.4 feet to a 7-inch spruce.

MONUMENT No. 15.

Post No. 15, 6.5 miles from the corner. It stands 75 feet north of the first high summit south of Otter lake, and 25 feet north of a large boulder 8 feet in diameter. To the east and west the ground is level, rises on the south toward the summit, and slopes downward on the north. The hillside is a granite formation.

At the monument the following bearings and distances were taken: N. 50° E. 11.8 feet to a 14-inch sugar maple; S. 15° W. 25 feet to a large boulder; S. 50° W. 12.3 feet to a 4-inch sugar maple.

MONUMENT No. 16.

Post No. 16, 6.98 miles from the corner. It stands one-quarter of a mile south of Otter Lake outlet. It is located in a forest of heavy beech and birch; 25 feet to the north are three large birch trees in a sink hole. The ground rises to the east and to the south for 50 feet, and slopes gently downward at the north into a swamp; at the west it rises for 75 feet, the downward into a thick balsam swamp.

At the monument the following bearings and distances were taken: N. 60° E. 10.6 feet to a 12-inch beech; N. 75° W. 7.1 feet to a 10-inch maple; N. 35° W. 7.7 feet to a 28-inch birch.

MONUMENT No. 17.

Post No. 17, 7.26 miles from the corner. It stands on the bank 200 feet south of west end of Otter lake, 30 feet south of low marsh and 500 feet east of the dam; in a thick scrubby spruce forest. The ground rises on the east and on the south for 30 feet, falling to north 30 feet to marsh.

At the monument the following bearings and distances were taken: N. 10° E. 3.6 feet to an 11-inch spruce; S. 75° E. 18.6 feet to a 6-inch birch; S. 20° W. 4.7 feet to a 12-inch spruce.

MONUMENT No. 18.

Post No. 18, 7.40 miles from the corner. It stands 14 feet north of the Otter Lake road in second growth timber. There are two large birch trees 25 feet northeast of the monument. The ground is level to the east and west, and on the north for about 150 feet, then rises a small knoll; to the south it slopes downward to Otter lake. It is 500 feet east of the dam.

At the monument the following bearings and distances were taken: N. 70° E. 5.9 feet to a 5-inch birch; S. 30° W. 17.5 feet to a 10-inch beech, and N. 35° W. 13.0 feet to a soft maple.

MONUMENT No. 19.

Button No. 1, 8.01 miles from the corner. It is set in a slanting granite rock, 2.8 feet north from crevice. It is about 300 feet southwest of West pond. The timber about the rock is second growth beech and birch. The ground slopes downward on the north, east and west, and runs level at the south for 150 feet to end of small rocky knoll.

At the monument the following bearings and distances were taken: N. 70° E. 15.7 feet to a 6-inch spruce; S. 45° E. 18.3 feet to an 8-inch spruce; S. 75° W. 8.7 feet to a 14-inch birch; N. 20° W. 14.2 feet to a 12-inch beech.

MONUMENT No. 20.

Post No. 19, 8.60 miles from the corner. It stands 1,000 feet down the north side of the second high summit north of Otter lake in a thick beech forest and near several large birch trees. The ground runs about level east and west from the monument, and to the northward and southward is a wide steep slope rising toward the north. The soil in the vicinity of the monument is of sand.

At the monument the following bearings and distances were taken: N. 50° E. 14.4 feet to an 18-inch birch; S. 70° E. 9.7 feet to a 14-inch beech; N. 50° W. 26.2 feet to an 8-inch spruce.

MONUMENT No. 21.

Post No. 20, 9.00 miles from the corner. It stands just to the left of a large granite boulder in a clean beech and maple forest, and on the north side of a hill 600 feet south of the summit of a very high hill to the north. There are also three small rocks 17 feet to the southwest. The ground is nearly level east and west but north and south there is a slope rising southwardly.

At the monument the following bearings and distances were taken: N. 20° E. 16.0 feet to a 6-inch beech; S. 30° E. 19.6 feet to a 6-inch beech; S. 55° W. 17.1 feet to a 12-inch spruce, and N. 45° W. 3.7 feet to a sugar maple.

MONUMENT No. 22.

Post No. 21, 9.54 miles from the corner. It stands in a thick beech woods and on a small ridge 400 feet north of a very high summit. The soil is of gravel. The ground gently slopes downward to the east and rises to the westward for 150 feet, thence it slopes off to the head of Crooked creek. It slopes gently downward to a small stream at the north and rises to the south to a small knoll, which is at the foot of the high summit.

At the monument the following bearings and distances were taken: N. 45° E. 17.3 feet to a sugar maple; S. 55° E. 6.5 feet to a 14-inch beech; N. 40° W. 21.0 feet to an 8-inch beech.

MONUMENT No. 23.

Post No. 22, 10.07 miles from corner. It stands in a thick spruce forest, 1300 feet south of a long beaver meadow. The monument is in a hollow, the ground rising to the north, falling to the south and running about level east and west.

At the monument the following bearing and distances were taken: N. 40° E. 33.8 feet to a 12-inch beech; S. 30° E. 6.0 feet to a soft maple; S. 55° W. 7.2 feet to an 8-inch hemlock; N. 15° W. 16.0 feet to an 8-inch birch.

MONUMENT No. 24.

Post No. 23, 10.53 miles from corner. It stands on the high summit 600 feet south of the Silver Mine Road and 700 feet north of a beaver meadow, in a very thick beech forest. The ground is level to the east and west and slopes downward at the north and south.

At the monument the following bearings and distances were taken: S. 65° E. 8.7 feet to a 12-inch beech; S. 75° W. 16.6 feet to a 14-inch beech; N. 15° W. 13.9 feet to a 4-inch beech.

MONUMENT No. 25.

Post No. 24, 11.107 miles from corner. It is located one mile south of Independence river, near a number of small boulders. Twenty feet to the west the ground rises to a small knoll, thence slopes downward to the north; to the south it runs level for 400 feet to a small hollow; to the east it slopes downward.

At the monument the following bearings and distances were taken: N. 45° E. 7.6 feet to an 8-inch spruce; S. 35° E. 7.6 feet to an 18-inch beech; S. 55° W. 23.3 feet to a 4-inch sugar maple; N. 35° W. 12.2 feet to a 12-inch birch.

MONUMENT No. 26.

Post No. 25, 11.52 miles from corner. It stands at the foot of what is known as Balsam Flats and is about 1,600 feet south of Independence river, and 1,300 feet east of dam on same. The soil is a gravel formation, and the ground about the monument is level for some distance; 600 feet to the south, however, it rises.

At the monument the following bearings and distances were taken: S. 25° W. 4.4 feet to a 12-inch birch; N. 40° W. 3.1 feet to a 6-inch hemlock; N. 25° W. 13.6 feet to a 12-inch hemlock.

MONUMENT No. 27.

Post No. 26, 12.08 miles from the corner. It stands in an open forest of birch and spruce, about 1,500 feet north of Independence river. The soil is of gravel. The ground is level to the east, rising toward the west and slopes gently downward to the south.

At the monument the following bearings and distances were taken: N. 20° E. 13.5 feet to a 12-inch spruce; N. 85° E. 13.0 feet to a 16-inch birch; N. 65° W. 17.9 feet to an 8-inch beech.

MONUMENT No. 28.

Post No. 27, 12.34 miles from the corner. It stands 20 feet north of Independence road; about a quarter of a mile north of Independence river and is in an open hardwood forest, the ground rises gently toward the west, slopes downward toward the north and east.

At the monument the following bearings and distances were taken: S. 20° W. 8.8 feet to a 15-inch hard maple; S. 50° W. 16.3 feet to a 24-inch birch.

MONUMENT No. 29.

Post No. 28, 13.006 miles from the corner. It stands 25 feet south of Fourth Creek road, and 175 feet north of Fourth creek, in a thick second growth forest. From the monument the ground rises east and north and slopes downward toward the south and west. The soil is of gravel.

At the monument the following bearings and distances were taken: N. 35° E. 3.6 feet to a 24-inch soft maple; S. 65° W. 17.2 feet to a 6-inch hemlock; N. 40° W. 16.0 feet to an 8-inch balsam.

MONUMENT No. 30.

Button No. 2, 13.516 miles from the corner. It is set in a flat rock, 25 feet square, 7 feet from north edge, and 8 feet from west edge. The forest about the rock is open, second timber and the rock is on a granite bluff about 600 feet south of Fifth creek. The ground falls gently to the east, west and south.

At the monument the following bearings and distances were taken: S. 0° E. 3.5 feet to a birch stump, and N. 85° W. 7 feet to an 8-inch spruce.

MONUMENT No. 31.

Post No. 29, 14.01 miles from the corner. It stands at the south end of small knoll in gravel soil, the timber about is mostly beech, birch and spruce. The ground runs level to the east and south and falls to the west for 10 feet. It runs level to the north for 12 feet thence down through a hollow to a knoll. There is an old hemlock slash all about this locality.

At the monument the following bearings and distances were taken: N. 50° E. 22.6 feet to a 12-inch birch; S. 15° E. 9.2 feet to a 5-inch soft maple; N. 25° W. 7.5 feet to a 6-inch soft maple.

MONUMENT No. 32.

Post No. 30, 14.54 miles from the corner. It is situated in a forest of a very large birch timber, about a mile north of Fifth creek and is on a narrow ridge running north-east and south-west. The ground slopes off gently west for 200 feet to a round top knoll; rises to the east for 10 feet when it drops down to a beech flat.

At the monument the following bearings and distances were taken: N. 50° E. 5.8 feet to a 6-inch soft maple; S. 35° E. 6.5 feet to a 6-inch birch; S. 55° W. 13.7 feet to a 6-inch birch; N. 55° W. 31.7 feet to a 12-inch spruce.

MONUMENT No. 33.

Post No. 31, 14.93 miles from the corner. It stands on a side hill near several large hemlock stumps; the ground falling to the north-west for 150 feet to a swamp, rising to the south for 75 feet and to the east. The soil about is a hemlock muck. An old lumber camp is about a mile to the westward.

At the monument the following bearings and distances were taken: N. 65° E. 22.3 feet to a 6-inch spruce; S. 25° W. 11.9 feet to a 5-inch spruce; N. 40° W. 17.7 feet to a 7-inch spruce.

MONUMENT No. 34.

Post No. 32, 15.48 miles from the corner. It is located in a thicket of second growth spruce and balsam, in which are many granite boulders. From the monument the ground falls to the westward, rises gently east, slopes to the south for 100 feet, then rises, and at the north it runs level for 600 feet to a small stream running west.

At the monument the following bearings and distances were taken: N. 55° E. 7.7 feet to a 6-inch spruce; S. 45°E. 7.9 feet to a 5-inch spruce; S. 50° W. 6.3 feet to a 13-inch beech.

MONUMENT No. 35.

Post No. 33, 15.773 miles from the corner. It stands on the second very high summit about one and one-half miles south of Beaver river. The ridge runs north-east and south-west and is covered with a clean beech forest. The ground runs about level east and west, falls to the north for 1,500 feet, then rises to another summit; at the south it falls rapidly for 700 feet to a swamp, runs level across this and rises again to another summit.

At the monument the following bearings and distances were taken: N. 27° E. 12.0 feet to a 6-inch beech; S. 15° E. 24.6 feet to a 6-inch spruce; S. 25° W. 27.2 feet to a 6-inch beech; S. 45° W. 23 feet to a 16-inch soft maple; N. 65° E. 9.0 feet to a 8-inch beech.

MONUMENT No. 36.

Post No. 34, 16.50 miles from the corner. It stands in a forest of very large beech timber in gravel soil and is about three-quarters of a mile south of Beaver river. The ground runs about level east and west, rises to the south for 75 feet to a small knoll, and falls gently to the north for 800 feet.

At the monument the following bearings and distances were taken: N. 70° E. 18.0 feet to an 18-inch beech; S. 10° E. 22.0 feet to a 12-inch beech; N. 55° W. 10.7 feet to a 6-inch beech.

MONUMENT No. 37.

Post No. 35, 17.068 miles from the corner. It is 35 feet south of the Stillwater road, 300 feet west of a small beaver-meadow creek. It stands in red gravel soil, in a burnt section of forest and near two large birch trees.

At the monument the following bearings and distances were taken: N. 30° E. 12.0 feet to a 24-inch birch; S. 30°E, 16.3 feet to an 8-inch birch; S. 80° W. 6.1 feet to a 10-inch hemlock stump.

MONUMENT No. 38.

Post No. 36, 17.43 miles from the corner. It stands 3 feet east of a sink hole on the western slope of a hardwood ridge, and about half a mile south of Beaver river. The ground rises to the east to a flat and falls gently west to Beaver lake.

At the monument the following bearings and distances were taken: S. 65° E. 5.8 feet to a 16-inch sugar maple; S. 40° W. 10.3 feet to a 4-inch soft maple; N. 45° W. 7.6 feet to an 18-inch beech.

MONUMENT No. 39.

Post No. 37. 17.699 miles from the corner. It stands in sandy soil 25 feet south of Beaver river, about 1,000 feet west of the mouth of Sunday creek and near a bushy top hemlock which overhangs the river.

At the monument the following bearings and distances were taken: N. 10° E. 12.3 feet to a 15-inch birch; S. 60° W. 16.1 feet to a 20-inch birch; N. 10° W. 8.0 feet to a 20-inch birch.

MONUMENT No. 40.

Post No. 38, 17.77 miles from the corner. It stands in gravel soil in the midst of which underbrush, 175 feet north of Beaver river and 800 feet west of a beaver meadow creek. It stands near the large birches and but a short distance from the boat landing at the head of Beaver lake.

At the monument the following bearings and distances were taken: S. 40° E. 11.4 feet to a 10-inch black cherry; S. 75° W. 10.3 feet to a 6-inch black cherry, and N. 35° W. 15 feet to a 5-inch soft maple.

MONUMENT No. 41.

Post No. 39, 18.327 miles from the corner. It stands 2.5 feet north of the Mosher pond road in a forest of small second growth timber. The ground is level east and west and for 50 feet north and south.

At the monument the following bearings and distances were taken: N. 45° E. 6.2 feet to a 5-inch spruce; S. 70° W. 18.5 feet to a 9-inch beech, and N. 10° W. 15.2 feet to a 6-inch spruce.

MONUMENT No. 42.

Post No. 40, 18.82 miles from the corner. It stands in gravel soil, on a side hill covered with second growth birch, soft maple, spruce and balsam. The ground slopes off from north to south into a swamp of spruce and balsam, and also slopes off gently toward the east.

At the monument the following bearings and distances were taken: N. 25° E. 14.8 feet to a 14-inch soft maple; N. 75° E. 3.5 feet to a 5-inch spruce, and S. 55° W. 10.2 feet to an 8-inch birch.

MONUMENT No. 43.

Button No. 3, 18.862 miles from the corner. It is set 10 inches from the south edge of a rock on a granite ridge, situated about three-quarters of a mile north of Beaver river and 1,200 feet west of Beaver Meadow creek. The ridge is covered with hardwood; it rises toward the north and west and drops abruptly to the east and south.

At the monument the following bearings and distances were taken: S. 85° E. 15.8 feet to a 7-inch hemlock; N. 65° W. 8.8 feet to a 20-inch birch; N. 45° W. 5.2 feet to a 6-inch hemlock.

MONUMENT No. 44.

Button No. 4, 19.249 miles from the corner. It is set 8.2 feet from the south edge of an isolated rock 25 feet square whose top slopes slightly westwardly. The rock is on a granite bluff about a quarter of a mile west of a beaver meadow creek, and about 40 feet lower than the high summit 700 feet to the northward.

The ridge falls rapidly to the east and west, runs level toward the south for 60 feet, then falls rapidly for 600 feet to the green timber. This is in the burnt district one and one-half miles from Beaver lake.

At the monument the following bearings and distances were taken: N. 35° E. 16.4 feet to a 12-inch soft maple; N. 85° 25.2 feet to a 15-inch soft maple.

MONUMENT No. 45.

Button No. 5, 19.773 miles from the corner. It is set in the rock at the east end of a high granite bluff running northeast and southwest, the rock is in the burnt district about two miles north of Beaver river, 600 feet south of Ikes pond and 1,000 feet west of Three Mile meadow. The button is on the peak of the ridge.

At the monument the following bearings and distances were taken: S. 40° W. 50.6 feet to a rock 3 feet square.

MONUMENT No. 46.

Button No. 6, 19.993 miles from the corner. It is set in a granite rock 25 feet north-west of the water edge of the west side of Ikes pond.

MONUMENT No. 47.

Post No. 41, 20.493 feet from the corner. It stands on the second bluff south of Alder creek, about one-half mile from same, and near the north edge of the burnt district. The bluff is nearly level on top for 40 feet east and west and 100 feet north and south. The soil is very dark muck; the green timber begins about 600 feet down the slope to the north.

At the monument the following bearings and distances were taken: S. 50° E. 9.2 feet to a dead beech trunk; N. 60° W. 39.6 feet to a rock 6 feet in diameter; N. 35° W. 20 feet to a rock.

MONUMENT No. 48.

Button No. 7, 21.05 miles from the corner. It is set in a granite rock, a rise north of Alder creek and in a bend of same, 55 feet west of Kettlehole Falls. There are no trees within a hundred feet of button.

MONUMENT No. 49.

Post No. 42, 21.25 miles from the corner. It stands in low swampy ground 15 feet north of the road leading from Belfort to Alder creek and about 400 feet west of Alder Creek camp.

At the monument the following bearings and distances were taken: N. 25° E. 19.0 feet to a 5-inch spruce; S. 50° W. 7.2 feet to a 6-inch balsam; N. 15° W. 20.4 feet to a 6-inch spruce.

MONUMENT No. 50.

Button No. 8, 21.547 miles from the corner. It is set in a rock on the high granite bluff 1,500 feet north of the Alder creek lumber camp. The bluff runs level toward the west, breaks off abruptly 20 feet east of button and slopes off rapidly to south and gently to north. No trees very near button.

At the monument the following bearing and distance was taken: S. 45° W. 20.0 feet to a 12-inch spruce.

MONUMENT No. 51.

Post No. 43, 22.065 miles from the corner. It stands in sandy soil, in a forest of second growth timber about half a mile north of Alder Creek Camp, on a small ridge running east and west.

The ground is level where the monument stands, but 30 fee the northwest it slopes downward into a large balsam swam

At the monument the following bearings and distances w taken: N. 86° E. 5.0 feet to a 6-inch spruce; N. 55° W. 6 feet an 8-inch hemlock; N. 10° W. 12 feet to a 10-inch beech.

MONUMENT No. 52.

Post No. 44, 22.571 miles from corner. It stands in a forest very large birch and soft maple on the west end of a high ridg The ground slopes downward to the south for 500 feet; at th north it rises gently for 40 feet then falls gradually; at the eas it runs level over a hardwood flat; and at the west it runs leve for 40 feet, then drops rapidly to a large balsam swamp.

At the monument the following bearings and distances were taken: S. 80° E. 8.4 feet to a soft maple; S. 10° E. 16.8 feet to a 6-inch hemlock; S. 75° W. 14.0 feet to a 12-inch hemlock; N. 35° W. 12.2 feet to a 6-inch hemlock.

MONUMENT No. 53.

Post No. 45, 23.001 miles from the corner. It stands in a little sink hole in an open forest of large birch and beech. The ground slopes downward on the west for 1,500 feet to Sand Pond: rises to the east for 50 feet, then runs level over a hardwood flat; rises for 40 feet southwardly then drops down to a hollow; on the north is rises for 40 feet, drops down and over a small knoll to a narrow stream.

At the monument the following bearings and distances were taken: N. 65° E. 11.4 feet to a 5-inch birch; S. 65° E. 4.3 feet to a 12-inch spruce; S. 60° W. 12.8 feet to an 8-inch birch.

MONUMENT No. 54.

Post No. 46, 23.53 miles from corner. It stands on a side hill of gravel, covered with beech and birch and is about half a mile southerly from the road to Strife's camp. The ground slopes downward at the south for 500 feet, then runs level; at the north it rises for 40 feet, descends gradually to a beech flat; it runs about level east and west.

At the monument the following bearings and distances were taken: N. 60° E. 17.0 feet to an 18-inch birch; S. 15° E. 5.8 feet to an 8-inch beech; S. 80° W. 11.9 feet to a 6-inch beech.

MONUMENT No. 55.

Post No. 47, 23.99 miles from the corner. It stands 6 feet south of road to Strife's camp and about 1,300 feet east of the old camp at the clearing. The ground runs level from the monument in all directions and is covered with a clean beech forest.

At the monument the following bearings and distances were were taken: N. 15° E. 21.8 feet to a 4-inch beech; S. 50° E. 23.1 feet to a 16-inch beech; S. 55° W. 15.3 feet to a 6-inch beech.

MONUMENT No. 56.

Post No. 48, 24.574 miles from corner. It stands near several old stumps in a forest of beech and birch. The ground falls gently to the south for 600 feet; it runs about level east and west.

At the monument the following bearings and distances were taken: N. 85° E. 16.3 feet to an 8-inch hemlock; S. 30° E. 9.6 feet to an 8-inch birch; S. 65° W. 8.7 feet to a 16-inch beech.

MONUMENT No. 57.

Post No. 49, 25.11 miles from corner. It stands in red sandy soil, on the north edge of a high bluff which is covered with a very old forest of beech and birch. The ground descends very rapidly toward the north for 300 feet to a small spring brook running east through the rocks at the foot of bluff; it also falls rapidly towards the east and runs about level west and south. The bluff is very high, it being possible to see for miles to north and northeast from this point.

At the monument the following bearings and distances were taken: N. 80° E. 20.2 feet to a 7-inch beech; S. 30° E. 9.5 feet to a 12-inch birch; N. 15° W. 8.2 feet to an 8-inch beech

MONUMENT No. 58.

Post No. 50, 25.50 miles from corner. The monument stands on a small knoll of gravel covered with second growth birch and a few balsam. The ground slopes downward on the east, south and west; at the north it falls gradually for 40 feet then through a balsam swamp 1,000 feet to a stretch of burnt ground, also just to the north is a very crooked little stream which crosses the line six times.

At the monument the following bearings and distances were taken: N. 12° E. 10.4 feet to a 12-inch birch; S. 55° E. 11.1 feet to a 14-inch dead birch stub; S. 55° W. 5.9 feet to a 14-inch soft maple.

MONUMENT No. 59.

Post No. 51, 25.83 miles from the corner. It stands in low marshy ground 30 feet south of the left hand bank of the west branch of the Oswegatchie river and about two miles east of Long Pond. The line crosses the stillwater about 40 feet west of the rapids. The ground about the monument is level, and is partially cleared.

At the monument the following bearings and distances were taken: N. 40° E. 19.8 feet to a 16-inch dead balsam; S. 33° E. 9.4 feet to a 10-inch pine stump; N. 55° W. 17.1 feet to a 7-inch birch.

MONUMENT No. 60.

Post No. 52, 25.989 miles from corner. It stands 8 feet west of the road running from the saw-mill up along the west branch of the Oswegatchie river. It is on a thick spruce ridge running north and south. The ground descends very rapidly to the west for 30 feet into a spruce swamp; on the east it runs level for 20 feet, breaks abruptly 10 feet into an open swamp in which there are some tamarack trees. The soil is yellow gravel covered with hemlock muck.

At the monument the following bearings and distances were taken: N. 60° E. 7.5 feet to a 5-inch birch; S. 73° W. 8.9 feet to a 6-inch hemlock; N. 48° W. 6.6 feet to a 6-inch spruce.

MONUMENT No. 61.

Post No. 53, 26.522 miles from corner, standing on the side of a slight rise of the ground of red sand, covered with hemlock muck and in an old hemlock slash. The ground rises gently to the north for 15 feet, then goes down and over a series of small knolls, at the south it runs level for 40 feet, then descends gradually for 200 feet to a swamp; at the west it runs about level and also east for 10 feet, then it breaks off abruptly to a swamp.

At the monument the following bearings and distances were taken: N. 20° E. 5.7 feet to a 16-inch spruce; S. 55° E. 6.2 feet to a 6-inch spruce; N. 8° W. 14.2 feet to a 12-inch soft maple.

MONUMENT No. 62.

Post No. 54, 27.06 miles from the corner. It stands in a thick forest of small birch, beech and spruce, the soil being a dark gravel rises to the north for 200 feet, then runs level; at the south it descends rapidly for 100 feet, then level for the same distance, then over a high knoll; on the west it rises for 200 feet and on the east falls rapidly for 150 feet to a beech flat.

At the monument the following bearings and distances were taken: N. 90° E. 9.4 feet to a 16-inch birch; S. 10° E. 7.5 feet to a 14-inch birch; N. 85° W. 4 feet to a 16-inch spruce.

MONUMENT No. 63.

Post No. 55, 27.33 miles from the corner. It stands 20 feet north of the road leading from Long Pond to No. 1 Camp and stands in rather an open forest of beech and spruce, and in a gray gravel soil. The ground rises on the north for 30 feet, then drops off into a hollow, at the south it descends for 500 feet; it rises gently to the west and slopes off toward the east.

At the monument the following bearings and distances were taken: N. 40 ° E. 21.9 feet to a 15-inch beech; S. 48° E. 9.3 feet to a 12-inch beech; S. 80° W. 5.5 feet to an 8-inch spruce.

MONUMENT No. 64.

Post No. 56, 27.50 miles from the corner. It stands on a rise of ground covered with small beach and spruce, sloping gently to the north for 40 feet then more rapidly for 500 feet; to the south it rises gently for 300 feet then drops into a small ravine; to the east and west it runs nearly level.

At the monument the following bearings and distances were taken: S. 30° E. 17.7 feet to an 18-inch beech; S. 75° W. 15.3 feet to an 8-inch beech; N. 35° W. 10.8 feet to a 14-inch beech.

MONUMENT No. 65.

Post No. 57, 28.97 miles from the corner. It is 1,500 feet southeast of Compo's lumber camp, in a forest of beech, birch and small spruce, and in a red gravel soil. The ground runs nearly level east and south and slopes downward to the north and west.

At the monument the following bearings and distances were taken: N. 70° E. 13.3 feet to a 32-inch beech; S. 68° E. 8.2 feet to a 6-inch spruce; N. 15° W. 2.7 feet to an 8-inch birch.

MONUMENT No. 66.

Post No. 58, 28.44 miles from corner. It stands on a level stretch, on top of a high summit at the south edge of old windfall. The forest is second growth timber and the ground slopes gently downward to the east and west.

At the monument the following bearings and distances were taken: S. 45° E. 11.4 feet to an 8-inch beech; S. 26° W. 17.6 feet to a 6-inch beech; N. 65° W. 9.3 feet to a 6-inch beech.

MONUMENT No. 67.

Post No. 59, 28.987 miles from the corner. It stands 12 feet south of road to Crimmon's Camp in an old burnt section where there are no green trees. The ground slopes off to the west and rises to the north, east and south.

At the monument the following bearings and distances were taken: N. 5° E. 41.7 feet to a dead birch stub; S. 50° E. 25.6 feet to a 20-inch dead birch; S. 67° W. 22 feet to a 12-inch soft maple.

MONUMENT No. 68.

Post No. 60, 29.47 miles from the corner. It stands about 1,000 feet south of the burnt section, in an open forest. The ground slopes gently toward the south for 300 feet then rises to a small knoll to the north it rises for 30 feet then falls for about 400 feet through a small valley and rises to a knoll.

At the monument the following bearings and distances were taken: N. 50° E. 23.4 feet to a 14-inch dead spruce; S. 85° E. 20.2 feet to a 10-inch soft maple; N. 60° W. 5.2 feet to an 8-inch soft maple.

MONUMENT No. 69.

Post No. 61, 29.995 miles from the corner. It stands 12 feet north of road from No. 1 Camp to Harrisville and in a hardwood forest. The ground slopes off toward the north for 500 feet then rises; to the south it rises for 300 feet to the burnt district; toward the east and west it runs about level.

At the monument the following bearings and distances were taken: N. 70° E. 4.9 feet to a 20-inch hard maple; S. 60° W. 19.3 feet to a 14-inch beech; N. 45° W. 19.8 feet to an 8-inch beech.

MONUMENT No. 70.

Post No. 62, 30.505 miles from the corner. It stands on a side-hill in rather an open forest. There is a rock 4 feet high one foot to the east, and to the west 30 feet is a ledge of rocks. At the south the ground rises 75 feet through a rocky ravine, at the north it slopes off gradually for 300 feet to a swamp.

At the monument the following bearings and distances were taken: N. 10° E. 5 feet to a 12-inch hemlock; S. 5° E. 24.4 feet to a 14-inch birch; S. 60° W. 12.5 feet to an 8-inch beech.

MONUMENT No. 71.

Button No. 9, 30.942 miles from the corner. It is set in a rock 75 feet south of the road from the Francis Camp to Harrisville. From the Button the rock slopes off to the south for 100 feet and then drops off abruptly 20 feet into a swamp.

At the monument the following bearings and distances were taken: N. 35° E. 27 feet to a rock; N. 70° E. 25 feet to a rock.

MONUMENT No. 71½.

Post No. 63, 30.956 miles from the corner. It stands on a summit on the south side of the road leading from the Francis Camp to Harrisville.

At the monument the following bearings and distances were taken: S. 66° E. 14.9 feet to a soft maple; S. 35° W. 13 feet to a 7-inch beech; N. 55° W. 20.2 feet to a 12-inch beech.

MONUMENT No. 72.

Post No. 64, 31.384 miles from the corner. It stands on the flat top of a high summit in a forest of beech, birch and spruce. The soil is red loam. To the south the ground descends gradually for 200 feet; to the north it descends rapidly for 500 feet and is about level east and west.

At the monument the following bearings and distances were taken: N. 65° E. to a 14-inch beech; S. 34° E. to an 8-inch beech; and N. 38° W. 7.9 feet to a 4-inch beech.

MONUMENT No. 73.

Button No. 10, 31.684 miles from the corner. It is set in the rock 2 8-10 feet from its edge and 10 feet south of the left hand bank of the middle branch of the Oswegatchie river at the "Tunnel." The forest is of spruce and hemlock.

At the monument the following bearings and distances were taken: N. 82° E. 19.5 feet to an 8-inch spruce; S. 45° W. 22.2 feet to a 6-inch hemlock; N. 50° W. 11.5 feet to an 8-inch spruce.

MONUMENT No. 74.

Post No. 65, 31.698 miles from the corner. It stands 10 feet north of the right hand bank of the middle branch of the Oswegatchie river at the "Tunnel" in a forest of large spruce and hemlock.

At the monument the following bearings and distances were taken: N. 20° E. 18 feet to a 12-inch soft maple; N. 55° E. 6.1 feet to a 6-inch spruce; N. 70° W. 18.2 to a 10-inch hemlock.

MONUMENT No. 75.

Post No. 66, 32.0 miles from the corner. It stands in a slight hollow, 1,535 feet north of the Oswegatchie river and about a quarter of a mile south of very high summit. The forest is largely spruce, with some beech and birch; and the ground rises gradually to northeast and descends gradually to the south-west.

At the monument the following bearings and distances were taken: S. 60° E. 8.2 feet to a 12-inch beech; S. 50° E. 11.0 feet to a 12-inch beech; N. 60° W. 16.3 feet to a 16-inch spruce.

MONUMENT No. 76.

Post No. 67, 32.554 miles from the corner. It stands on the north edge of a level hardwood ridge 150 feet in width at foot of the high summit 1,000 feet to the south. The ground runs about level east and west; at the north it slopes off gradually for 150 feet then is about level through a spruce swamp to a small stream running west.

At the monument the following bearings and distances were taken: N. 35° E. 10.2 feet to a 20-inch hemlock; N. 80° E. 5.2 feet to a 12-inch beech; N. 25° W. 9.0 feet to a 24-inch spruce stub.

MONUMENT No. 77.

Post No. 68, 33.0 miles from the corner. It stands in a rather young open forest of hardwood with some spruce. The ground is nearly level about the monument, but about 70 feet to the north it rises, then descends to a small brook running west. Old hemlock stub 5 feet to west.

At the monument the following bearings and distances were taken: N. 40° E. 12.6 feet to a 6-inch beech; N. 90° E. 14.3 feet to a 12-inch beech; S. 15° W. 14.5 feet to an 8-inch spruce; S. 80° W. 5 feet to a 30-inch hemlock stub; N. 30° W. 15 feet to a 14-inch beech.

MONUMENT No. 78.

Post No. 69, 33.216 miles from the corner. It stands on the south edge of the second knoll north of small stream, where ground breaks sharply to the south-west, 30 feet north-east of very large boulder standing on south slope of knoll. Timber is of hemlock, spruce and maple.

At the monument the following bearings and distances were taken: N. 41° 30′ E. 6.7 feet to a 6-inch hemlock; S. 31° 30′ E. 11.4 to an 8-inch hemlock; S. 60° W. 5.5 feet to an 18-inch white maple; N. 18° W. 12.8 feet to a 7-inch hemlock.

MONUMENT No. 79.

TERMINAL MONUMENT.

Post No. 70, 33.372 miles from the corner. This monument marks the north end of the line between the counties of Lewis and Herkimer and its intersection with the south line of St. Lawrence county. The monument stands on a short sharp north-westerly slope leading to Mink Creek which at this point flows southwesterly—it is 15 feet west of the south end of a precipitous ledge 20 feet high and 110 feet south and 115 feet southeast of the south bank of the creek.

At the monument the following bearings and distances were taken: N. 23° E. 44.4 feet to a 12-inch spruce N. 41° E. 27.8 to a 6-inch birch; S. 70° W. 24.4 to a 14-inch spruce.

Improvement of Public Highways.

BULLETIN NO. 1—APRIL, 1899.

(Referred to in State Engineer and Surveyor's Report as Appendix A.)

The subject of Road Improvement in the State of New York is of such vital importance to the farmer and producer of this great commonwealth, that the State Engineer and Surveyor, in whose charge such improvements have been placed by an act of legislature, deems it not amiss to issue a bulletin embodying the main points and arguments for the betterment of the conditions which prevail at the present time, and to urge upon the farmer the necessity of his aid by voice and ballot to bring about an annual appropriation to attain such betterments and improvements.

In any well-governed community the necessity of improved highways is fully recognized and the great influence of good roads on the prosperity of the country, was well known to the ancients. In ancient Greece much care was given them, and the Carthagenians were scientific road builders. The Romans learned the art from the Carthagenians and excelled in the construction of their highways. In Peru the Incas built roads, the remains of which bear witness to their excellence. In Europe, after the decline of the Roman Empire, the roads were more and more neglected and allowed to fall out of repair, and until the middle of the eighteenth century little or nothing was done to improve them. At about that time both England and France commenced to turn their attention to the subject again, and Tresaguet, Macadam and Telford came to the front as champions of good roads, by advocating the methods of construction so widely known and so closely followed to the present day.

In Europe much attention and scientific research has been given to highways, both as a means of commercial inter-communication and to facilitate the movements of troops; and infinite care has been bestowed upon their construction and maintenance, for, no matter how well a road may be built of Macadam or kindred class, originally, it will soon deteriorate, if not guarded with the greatest care. Dust must be swept off in dry weather and mud removed after wet weather. Ruts must be filled with material placed handily for such purpose, and side ditches and drains kept clean of all obstructions. So much depends upon their intelligent supervision that the subject will be taken up in detail in a later bulletin, as will also the advisability of the use of wide tires on wagons.

It is the aim of this State to aid in the construction of such roads, and for this purpose we find in our statute books, chapter 115 of the Laws of 1898, "An act to provide for the improvement of the public highways." As many citizens are unfamiliar with the provisions or wording of this law, it is thought advisable to reproduce the same for their benefit.

STATE OF NEW YORK.

Chap. 115, Laws of 1898

AN ACT to provide for the improvement of the public highways.

Became a law March 24, 1898, with the approval of the Governor.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

Section 1. The board of suprevisors in any county of the state may, and upon presentation of a petition as provided in section two hereof, must pass a resolution that public interest demands the improvement of any public highway, or section thereof situate within such county, and described in such resolution, but such description shall not include any portion of a highway within the boundaries of any city or incorporated village, and within ten days after the passage of such a resolution shall transmit a certified copy thereof to the state engineer and surveyor.

§ 2. The owners of a majority of the lineal feet fronting on any such public highway or section thereof in any county of the state may present to the board of supervisors of such county a petition setting forth that the petitioners are such owners and that they desire that such highway or section thereof be improved under the provisions of this act.

§ 3. Such state engineer upon receipt of such resolution shall investigate and determine whether the highways or section thereof sought to be improved is of sufficient public importance to come within the purposes of this act, taking into account the use, location and value of such highway or section thereof for the purposes of common traffic and travel, and after such investigation shall certify his approval or disapproval of such resolution. If he shall disapprove such resolution, he shall certify his reasons thereof to such board of supervisors.

§ 4. If he shall approve such resolution, such state engineer shall cause the highway or section thereof therein described to be mapped both in outline and profile. He shall indicate how much of such highway or section thereof may be improved by deviation from the existing lines whenever it shall be deemed of advantage to obtain a shorter or more direct road without lessening its usefulness or wherever such deviation is of advantage by reason of lessened gradients. He shall also cause plans and specifications of such highways or section thereof to be thus improved to be made for telford, macadam or gravel roadway or other suitable construction, taking into consideration climate, soil and materials to be had in the vicinity thereof and the extent and nature of the traffic likely to be upon such highway, specifying in his judgment the kind of road a wise economy demands. The improved or permanent roadway of all highways so improved shall not be less than eight feet nor more than sixteen feet in width unless for special reasons to be stated by such state engineer it is required that it shall be of greater width. He shall if requested by the resolution include provision for steel plate or other flat rail construction in double track.

§ 5. Upon the completion of such maps, plans and specifications such state engineer shall cause an estimate to be made of the cost of construction of the same and transmit the same to the board of supervisors from which such resolution proceeded, together with a certified copy of such maps, plans and specifications, and of his certificate of the approval of the highway or section thereof so designated as aforesaid.

§ 6. After the receipt thereof upon a majority vote of such board of supervisors, it may adopt a resolution that such highway or section thereof so approved shall be constructed under the provisions of this act, or of any existing act, and thereupon shall transmit a certified copy of such resolution to such state engineer.

§ 7. In case the boundaries of such proposed highway shall deviate from the existing highway, the board of supervisors must make provision for securing the requisite right of way prior to the actual commencement of the work of improvement.

§ 8. Upon receipt of the certified copy of the resolution provided in section six, such state engineer shall advertise for bids for two successive weeks in a newspaper published at the county seat of such county, and in such other newspaper as shall be deemed of advantage for the construction of such highway or section thereof, according to such plans and specifications, and award such contract to the lowest responsible bidder, except that he may in his discretion award the contract to the board of supervisors of the county or the town board or boards of the town or towns in which such highway lies, and except that no contract shall be awarded at a greater sum than the estimate provided in section five. But if no bid otherwise acceptable be made within suchestimate,such state engineer may amend his estimate, certify the same to the board of supervisors, and upon the adoption by it of a resolution as provided in section six based on such amended estimate, proceed anew to obtain bids and award the contract as herein provided. Such engineer may reject any or all bids, and before entering into any contract for such construction he shall require a bond with sufficient sureties conditioned that if the proposal shall be accepted, the party thereto will perform the work upon the terms proposed and within the time prescribed and in accordance with the plans and specifications; and as a bond of indemnity against any direct or indirect damages that shall be suffered or claimed during the construction of such road; and until the same is accepted. The people of the state of New York shall in no case be liable for any damages suffered. Partial payments may be provided for in the contract, and paid in the manner herein provided when certified to by such state engineer to an amount not to exceed seventy-five per centum of the value of the work done; twenty-five per centum of the contract price shall be retained until the entire work has been accepted. Whenever a county engineer has been appointed in the county in which such highway or section thereof is to be constructed, he shall have general charge and supervision of the work under the direction of such state engineer and shall report to him from time to time the progress of the work and such facts in relation thereto as may be required. If there is no county engineer, such state engineer shall have some competent person to superintend and have engineering supervision of the work.

§ 9. One-half of the expense of the construction thereof shall be paid by the state treasurer upon the warrant of the comptroller, issued upon the requisition of such engineer, out of any specific appropriations made to carry out the provisions of this act. And one-half of the expense thereof shall be a county charge in the first instance, and the same shall be paid by the county treasurer of the county in which such highway or section thereof is, upon the requisition of such engineer, but the amount so paid shall be apportioned by the board of supervisors, so that if the same has been built upon a resolution of said board without petition, thirty-five per centum of the cost of construction shall be a general county charge; and fifteen per centum shall be a charge upon the town in which the improved highway or section thereof is located, and if the same has been built upon a resolution of said board after petition as provided in section two, thirty-five per centum shall be a general county charge and fifteen per centum shall be assessed upon and paid by the owners of the lands benefited in the proportion of the benefits accruing to said owners as determined by the town assessors in the next section hereof.

§ 10. The town assessors of any town in which any highway or section thereof has been improved or constructed pursuant to petition as provided in section two of this act, shall have power and it shall be their duty upon receiving notice from the board of supervisors of the county in which said town is located, of the cost of construction or improvement of such highway or section thereof in such town, to assess an amount equal to fifteen per centum of said total cost upon the lands fronting or abutting on such highway or section thereof. Such assessment shall be apportioned according to the benefits accruing to the owners of the lands so located, according to the best judgment of said assessors, upon at least ten days' notice of the time and place of such apportionment to the persons affected thereby, and after such persons have had an opportunity to be heard, and the assessments so made when duly attested by the oaths of such assessors shall be collected in the same manner as the general taxes of such town are collected.

§ 11. The construction and improvement of highways and sections thereof, under the provisions of this act, shall be taken up and carried forward in the order in which they are finally designated, as determined by the date of the receipt in each case of the certified copy of the resolution provided in section six by such engineer as hereinbefore provided.

§ 12. Upon the completion of such highways or sections thereof, so constructed by such engineer, and his acceptance of the same, and after payment has been made, as herein provided, such engineer shall inform the board of supervisors of such county that the highways or sections thereof designated have been constructed as herein provided, and his duties in regard to the same are finished; and he may serve notice on said board to accept such highway thus constructed, which notice shall be filed in the office of the clerk of said county; and twenty days after the service and filing of said notice, such highway or section thereof shall be deemed accepted by said board of supervisors of such county; and thereafter they shall maintain the same as a county road, and apportion the expense as they may be empowered by law.

§ 13. All persons owning property abutting on such road so improved, or residing thereon, shall thereafter pay all highway taxes assessed against them in money, in the manner now provided by law.

§ 14. Whenever any county has had aid in building any such highway, and it seems advantageous to such state engineer that a section or sections of highway, not exceeding one mile in length, should be constructed under this act to connect these roads together, and would be of great public utility and general convenience, he may serve notice on the board of supervisors of such county, and shall file one in the county clerk's office, designating the highways already constructed and the existing termini, and the section or sections, in his opinion, necessary to be constructed and his reasons therefor. And it shall be the duty of the board of supervisors to provide for the construction of such connecting highway or section thereof, within one year after the service and filing of such notice under this act.

§ 15. In addition to his other powers and duties, the state engineer and surveyor shall compile statistics relative to the public highways throughout the state and shall collect all information in regard thereto deemed expedient. He shall investigate and determine upon various methods of road construction adapted to different sections of the state, and as to the best methods of construction and maintenance of roads and bridges, and such other information relating thereto as he shall deem appropriate. He may be consulted at all reasonable times by county, city, town or village officers having care and authority over highways and bridges, and shall advise such officers relative to the construction, repair, alteration or maintenance of the same; and shall furnish such other information and advice as may be requested by persons interested in the construction and maintenance of public highways, and shall, at all times, lend his aid in promoting highway improvement throughout the state. He shall hold in each year at least one public meeting in each county, and shall cause due notice of such meeting to be given. He shall co-operate with all highway officers and shall assist county and town authorities, and when requested by them, furnish them with plans and directions for the improvement of the public highways and bridges.

§ 16. He shall report annually to the legislature concerning all the work performed by him, together with such recommendations upon the subject of highway construction and maintenance as to him shall seem appropriate.

§ 17. The commissioners of highways and town board of any town, and the board of supervisors of any county, and all other officers who now have or may hereafter have by law the care and supervision of the public highways and bridges shall, from time to time, upon his written request, furnish him with all available information in connection with the building and maintenance of the public highways and bridges in their respective localities.

§ 18. The operation of this act shall not be affected by any special act, but the highways may be improved under this act or such special act wherever the same may now exist.

§ 19. This act shall take effect immediately.

In the United States but little has been done toward road improvement; but in the eastern states, Massachusetts stands at the head, closely followed by New Jersey in this endeavor. As the matter is still in its infancy in this state, and the workings of the law in Massachusetts have been tried for some years and with excellent results, it is deemed wise to follow somewhat on their mode of procedure, in as far as a certain system to be followed is concerned. In the details of construction, only the best methods will be adopted, based on the experience of men who have made the subject of road building a life study.

In the Senate Bill No. 330, of 1897, introduced by Hon. Richard Higbie, it was proposed " to levy in the general appropriation act of each year, a tax, rated at one-tenth of a mill upon the entire valuation of the state which shall be known as the highway tax." The total assessment of taxable property for the year 1898 is stated by the report of the Tax Commissioners to be $5,170,874,650. This sum, when taxed at the rate of one-tenth of a mill, would give an annual amount of $517,087, available for the purpose of construction of state highways. On this basis each tax payer would contribute onty ten cents on each $1,000 of assessed valuation. Of this $517,087, the counties of Albany, Erie, Kings, Monroe, New York, Oneida, Onondaga, Queens, Westchester and Rensselaer, being the counties containing most of the largest cities in the state, contribute 78.9 per cent., leaving 21.1 per cent., to be paid by the remaining fifty-one counties. This is of significance, in view of the fact that according to the provisions of chapter 115, none of the improvement fund can be used on highways within the boundaries of incorporated villages or cities, and so the money is all expended in the rural districts, although the larger proportion of it is obtained from the cities. This is not so unfair, however, as might be thought at a first glance, as the increased business brought to the towns by the improved roads amply repays the small expenditure incurred by the tax. That these benefits are fully appreciated by the inhabitants of our cities is shown by the fact that they are the foremost of the advocates for an improvement in the condition of our public highways.

To give an idea of the enormous cost of hauling over the unimproved roads of our country, reference is made to Circular No. 31

of the United States Department of Agriculture, office of Road Inquiry. In it, General Roy Stone, Engineer in Chief of that office, says, in 1895, in a communication addressed to Mr. O. Dorner of Milwaukee, Wis.:

"Taking the census returns of the farm products of the United States for 1890, adding 8 per cent. for the increase in five years, finding the weight of the various articles and reducing the total to tons of 2,000 pounds, we have a total weight of farm products for the year 1895 of 219,824,247 tons. No information is available as to the amount of hay and grain consumed upon the farms where they are raised, nor is there any return of the large classes of material moved over the country roads, among which are building, fencing and road materials, fertilizer, coal, ore, etc., metals, meats, eggs, and poultry, straw and fodder, garden products, merchandise of various kinds and farm machinery. It is safe, however, to offset these various items against home consumed hay and grain, and so count the equivalent of the total farm product as being hauled on the public roads. The Chief of Forestry of this Department makes the very safe estimate that 5,750,000,000 cubic feet of lumber mill products and lumber used for fuel are hauled over the public roads, to which add timber used for railroad construction, 485,000,000 cubic feet, makes a total of 6,235,000,000, at thirty pounds per cubic foot gives 93,525,000 tons which, added to the farm products above, give 313,349,227 tons, at the average cost stated of $3.02 per ton, makes a grand total for the annual cost of hauling on the public roads of $946,414,665. The immensity of this charge will be best realized by comparing it with the values of all farm products in the United States for the year 1890, viz.: $2,460,179,454." And General Stone again says at the present day: "Our information regarding the cost of hauling in foreign countries and in a few good road districts of this country, indicates that nearly two-thirds of this total is due to the bad conditions of the roads."

The price used by Gen. Stone in the above calculation was arrived at in the following manner:

In November, 1895, the United States Department of Agriculture, through its office of Road Inquiry, sent out 10,000 circulars to farmers in all parts of the United States, asking for information regarding the average cost of hauling a load of crops to market. Replies were received from over 1,200 counties distributed among the United States, and the results were carefully compiled. The weight of loads hauled varied between an average of 2,409 pounds in the prairie states and an average of 1,397 pounds in the cotton states, the average weight of farm loads for the whole country being 2,002 pounds, or practically a ton. The average length of haul was found to be 12.1 miles, varying between 5.9 miles in the eastern states and 23.3 in the Pacific and mountain states. The average cost of marketing a ton of crops in the United States was found to be $3.02. It was as high as $5.12 in the Pacific and mountain states, due to long hauls, and as low as $1.87 in the northern and eastern states, which are more densly settled, and where railroads are numerous and hauls are shorter. The average cost of hauling a ton a distance of one mile was 25 cents, it being 22 cents in the prairie and Pacific and mountain states, and rising as high as 32 cents in the eastern states.

The detailed results of this investigation are published in Circular No. 19 of the office of Road Inquiry at Washington, which will be mailed upon request.

A comparison as to the average cost of hauling crops on the improved roads of Europe was instituted by means of reports from the United States Consuls stationed in England, France, Germany, Belgium, Italy and Switzerland. These reports will be found in detail in Circular, No. 27 of Road Inquiry office and may be had at any time. Briefly summarized we have the following result: The average cost of hauling farm products in England as reported by our consuls there, is a little less than 10 cents per ton per mile. In France it is the same. In Germany the average cost is 6½ cents. In Belgium 9½ cents. In Italy 7½ cents. In Switzerland, a mountainous country, farm products are hauled for 8 cents per ton per mile.

Adding all the figures reported by the various consuls, it appears that European farm products are hauled to market at an average cost of 8.6 cents per ton per mile, which is just a trifle more than one-third of the cost of marketing farm products in the United States.

This is the basis that General Stone uses for his statement that nearly two-thirds of the vast expenditure of $946,414,665 for hauling crops to market in the United States is directly chargeable to the bad conditions of the roads.

Such a statement emanating from the officers of the United States Government, who have no further interest than a desire to arrive at a true statement of facts, must impress the most skeptical, and it should become the aim of every farmer or producer to further the course of "Goods Roads" both by individual and united effort.

Since the passage of the law governing road improvement in the State of New York, many counties have grasped the opportunity to avail themselves of the State's offer to pay one-half of the expense of construction; but the appropriation of $50,000, made in 1898 to carry out its provisions was so small, that only a few pieces of highway could be improved. These few stretches of road are intended to serve as object lessons and local examples of good road building, and it is confidently expected that their influence will be felt in a substantial manner during the coming year. The number of petitions which have been received already, shows that the various counties are fully alive to the State's advantageous offer, but they must see to it that their representatives will insist on an annual appropriation of an adequate sum to make the carrying out of their petition a possibility. This department is heartily in sympathy with the movement to improve the roads of this State, and will do everything in its power to aid in carrying out to the very best advantage every provision of chapter 115, and that the funds placed at its disposal are distributed in the best possible manner among the various counties applying for assistance.

Up to March 1st the following petitions had been received and contracts let:

Erie county, 7 petitions, 48 miles; Orange county, 8 petitions, 141 miles; Rockland county, 11 petitions, 38 miles; Monroe county, 15 petitions, 102 1-3 miles; Columbia county, 1 petition, 2 miles; Schenectady county, 5 petitions, 2 miles; Oneida county, 2 petitions, 2½ miles; Onondaga county, 8 petitions, 2½ miles; Rensselaer county, 4 petitions, 17 2-3 miles; Orleans county, 1 petition, description so meagre cannot tell the exact distance; Chemung county, 2 petitions; Clinton county, 5 petitions; Herkimer county, 4 petitions; Montgomery county, 1 petition, 94 miles; Westchester county, 1 petition; Albany county, 1 petition; Delaware county, 2 petitions; St. Lawrence county, 1 petition; total, 79 petitions, 450 miles.

The following contracts have been let:

Contract No. 1. Troy and Schenectady turnpike, Schenectady county, distance 2 miles, at $7,295 per mile.

Contract No. 2. River road leading from Deerfield Corners. N. E'ly, in the town of Deerfield, Oneida county; price per mile $6,136, distance 2¾ miles.

Contract No. 3. New Lebanon and Pittsfield road in Columbia county; distance 6,000 feet, at $5,863 per mile.

Contract No. 4. White Corners plank road, between the city line of Buffalo and village of Hamburg, Erie county; distance 6.54 miles, at $3,784 per mile.

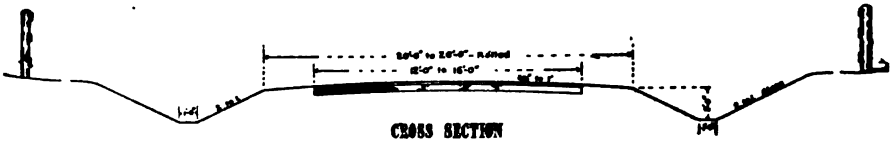
Contract No. 5. East Avenue road from Brighton to Fairport, Monroe county; distance 2.45 miles at $4,285.71 per mile.

A total of 15 miles in round numbers. Taking this from the 450 miles of road petitioned for, we have a remainder of 435 miles to be built under the petitions now on file, which would call for a sum much too large to be appropriated in one year. The necessity for immediate action on the part of all interested parties is therefore obvious.

As a practical illustration of the cost to the taxpayer of a road built under this State Aid Law, I cite the Deerfield road (contract No. 2). I cite this road as it is the only one in regard t which I have information as to the local assessed valuation as furnished by the Oneida County Good Road League, whose secretary's office is located in Utica. The total cost of that road i round numbers is $14,686. Of this, the State pays 50 per cent., o $7,343. The county pays 35 per cent., or $5,140. The proper benefited pays 15 per cent., or $2,202. The 50 per cent. paid b the State comes out of the $50,000 raised by the law of 189 and amounts to 1 cent on each $1,000 of assessed valuation f each taxpayer throughout the State. On the assessed valuation of Oneida county each taxpayer paid 6¾ cents on each $1,000 to raise the 35 per cent. paid by the county. So that each taxpayer in the county of Oneida paid only 7¾ cents on each $1,000 of assessed valuation for the Deerfield road, in addition to which the remaining $2,202 will be paid by the owners of the property benefited by the improvement.

As will be seen from the foregoing, there are a large number of petitions yet remaining, upon which no action has been taken, and in regard to which nothing further can be done at the present time, as the contracts already let will exhaust the appropriation of 1898 by the time all the contracts are completed, as in addition to the amount to be paid to contractors there will be additional expenses for engineering; and out of the original appropriation of $50,000, about $4,000 has been spent in surveys and plans, etc., on roads for which no contracts have been let as yet, but which work will be of value whenever the status of funds permits of letting new contracts and completing the work on those particular roads.

The manner in which it is intended to carry out the provisions of the law may best be shown by a sketch showing a cross-section with open ditches and the specifications adopted by the State Engineer for one of the improved sections to serve as a local object lesson, a copy of which follows:



CROSS SECTION
(with open ditches)
New York State Improved Roads.

SCALE.

Road No.;— Public Highway Improvement State of Nev

CHAPTER 115, LAWS OF 1898.

SPECIFICATIONS GOVERNING THE IMPROVEMENT OF M
THE ROAD, BETWEEN THE A
VILLAGE OF , IN THE TOWN OF ,
COUNTY, N. Y.

WORK TO BE DONE.

The work to be done under these specifications will con grading the road to the established grade lines, constructi necessary drains, ditches, and culverts, and laying a si macadam surface 16 feet wide and all other work necessa the proper fulfillment of the contract, according to the m and intent of the plans and specifications, which plans are hereof. The lump sum named in the contract will cover th of all the work and materials necessary for completion.

The contractor will be required to do all the clearing and bing, all excavations and embankments, all levelling, dit grading and surfacing, all masonry and stonework, and to fu all materials for the same. He will be required to build all ways, drains and culverts, to clear away all rubbish which obstruct the roadway or the water-ways. He will be requir protect all fences and to repair or replace the same if they be damaged or destroyed by him or by his employees. In sho will be required to furnish all the materials, implements and required to build and put in complete order for use, the said miles of road. He will be required to remove from the and from adjoining property all rubbish and surplus mate pertaining to the work, which may have accumulated durin prosecution.

The whole work must be conducted and completed to the s faction of the State Engineer and Surveyor.

EARTHWORK.

All trees, stumps, brush, sod and roots within the roadbed and on the slopes shall be grubbed up and removed as the Engineer may direct. The road between fences shall be cleared of brush.

The roadway shall be graded throughout its entire length to the width of 26 feet between ditches, and shall conform to the lines and grades, as shown on the plans, and as given by the Engineer.

The side ditches and slopes shall be neatly and truly cut with side slopes of section shown upon plans.

The bottom of ditches shall be cut true to the grades as shown upon plans and as furnished by the Engineer in charge.

All rock, boulders or stumps shall be excavated to a depth of at least six inches below sub-grade. Wherever such rock or boulders have been excavated, a sufficient amount of clear, fresh earth, sand or gravel, approved by the Engineer, shall be furnished and placed so as to make the surface conform to the required sub-grade.

Where clay or rock bottom is encountered it shall be excavated to a uniform depth of three inches below sub-grade for the entire width between ditches, and the Contractor shall supply and place a sufficient amount of clear loam, sand or gravel, approved by the Engineer, to make the surface of the macadamized portion conform to the required sub-grade and the shoulders beyond the macadamized portion conform to the lines and grades shown on the plans.

If quicksand, fine dust, spongy material or vegetable matter is encountered, it shall be removed to such depth as may be required by the Engineer and replaced by sufficient gravel, sand or loam, approved by the Engineer, to make a firm and stable foundation conforming to the required grade.

Where there is sod, or a hard, smooth surface upon the original surface of the ground, it shall be thoroughly broken up and all sod and vegetable matter removed before any embankment is formed thereon, so as to form a proper bond with the new materials.

Embankments shall be formed of clear earth or other materials, satisfactory to the Engineer, and shall be free from vegetable matter or refuse of any kind.

All embankments shall have side slopes as shown upon the plans, but in no case shall slopes be steeper than the "angle of repose" of the material. They shall be constructed in successive layers not exceeding six inches in thickness, and each layer shall be thoroughly rolled with a sectional iron roller weighing not less than two tons. The several sections of such roller to be about three inches wide on their faces and to vary alternately in diameter about three inches. The rolling shall be continued during the making of the embankment and until the Engineer directs it to be stopped. All embankments must be sprinkled as the Engineer directs, while rolling thereof is being done.

Surplus excavation shall be used to widen embankments or in such other places as the Engineer may direct.

All surfaces and slopes shall be left with neat, even surfaces, and in conformity with lines and directions given by the Engineer.

ROLLING SUB-GRADE.

After the surface of the sub-grade has been properly shaped and before any broken stone is applied, the sub-grade shall be thoroughly rolled and compacted. This rolling shall be done with a macadam steam-roller weighing not less than ten (10) tons and so built that it shall exert a pressure of not less than 500 pounds to the linear inch, measured across face of rollers. All hollows and depressions developing during the rolling shall be filled with material acceptable to the Engineer, and the rolling shall be continued until no depressions can be formed with the roller.

When the sub-grade consists of sand which will not consolidate when wet under action of roller, the roadbed shall be formed to the desired shape and then covered with one layer of broken stone, sufficient in quantity for fragments to touch each other. This shall then be wet and rolled until consolidated.

When the sub-grade consists of sticky clay too great in extent to be removed, this shall be formed to the desired shape and then covered with about four inches of sand. This shall then be rolled until consolidated.

No broken stone shall be placed on this sub-grade until the latter has been accepted by the Engineer.

Sub-grade drains.—Blind drains shall be placed in shoulder on each side every 100 feet, as directed by the Engineer. The stones to form them may be cobbles or coarse gravel.

UNDERDRAINS—VITRIFED PIPE AND POROUS TILE.

Lateral underdrains shall be provided on one or both sides of the road, where shown on the plans, to drain flat and wet portions of road. For a length of 500 feet and over, these shall be of six-inch vitrified tile, first quality, salt glazed, free from blisters and cracks, straight and round. No chipping shall be allowed to insert spigot end into bell.

The trench for the drain, about four feet deep, shall be dug to the line and grade furnished by the Engineer. The bottom shall be covered with two or more inches of gravel or gravelly earth and the pipe shall be laid as fast as the trench is ready. The minimum slope for lateral drains shall be two-tenths of a foot per hundred feet, except in special cases where one-tenth foot per hundred feet may be used with extreme care in laying. Each length of pipe shall be laid with the bell up stream.

The lower one-third of each joint shall be filled with mortar formed of equal parts of American Portland cement and sand; the upper two-thirds of the bell shall be filled with a roll of oakum, pushed in after pipe is laid.

The pipe shall be covered as laid, with six inches or more of gravel or porous earth, placed, packed and tamped around, under and over it, and the trench shall then be filled with the best available porous material, not clay, acceptable to the Engineer. During the laying of the pipe, and until the completion of the drain, there shall be kept inside the drain a close-fitting bunch of burlap fastened securely around the end of a four-foot handle; this shall be drawn forward as each joint is added in order to remove any mortar which may project inward at the joints, and to prevent any stones or other obstructions from being left within the drain.

Porous tile may be used, when so shown on the plans, for the shorter side drains or for transverse drains; where so used, the tile must be cylindrical, of first quality, well burnt, cherry color, straight, sound and free from cracks. The trench must be fitted to receive the tile by cutting its bottom accurately to grade, with a special scoop made to fit the shape of the tile. The ends of the tile shall be laid in close contact, and each joint shall be covered with a piece of burlap twelve inches square, folded twice. The trench shall be filled as provided above for laying vitrified pipe.

SAMPLES OF BROKEN STONE.

The Contractor shall be required to submit with his bid samples of the stone which he proposes to use in the construction, and no stone will be allowed to be used which the Engineer shall consider to be inferior in quality to the samples submitted by the Contractor, or exhibited as hereinafter specified.

QUALITY OF BROKEN STONE.

The broken stone and screenings must be of stone of hard and compact texture and uniform grain. They must be broken as nearly cubical as possible, and be screened through a rotary screen having at least three sizes of circular openings therein. They must have on all sides a rough surface obtained by fracture. Water-worn pebbles or crushed cobblestone will not be accepted. Disintegrated and weather-worn stone from the surface of a quarry will not be accepted. The stone for the different courses must be well screened and free from sand, loam, vegetable or other injurious matter.

KIND AND SIZES OF BROKEN STONE.

The broken stone shall be of two courses. The bottom course will be four inches thick and may consist of trap rock, granite, or any of the harder grades of limestone, or of dolomitic sandstone in case the latter shall be found by tests to be satisfactory, not inferior to the specimen exhibited in the offices of the State Engineer and Surveyor and of the Engineer of the   Division, which stone shall be broken in sizes varying from a minimum of one and one-half inches to a maximum of three inches in their longest dimensions.

The top course shall be two inches thick after rolling and shall consist of trap rock broken in sizes varying from a minimum of one inch to a maximum of two inches in their longest dimensions.

Limestone screenings not exceeding one-half inch in size and free from all dirt shall be added to fill all interstices that cannot be filled by the rolling or compacting of the other stone. Such screenings must be free from earth, sand, loam, or vegetable matter and shall contain all the dust of fracture.

SPREADING AND ROLLING.

After the earth foundation has been completed agreeably to these specifications and has passed the inspection of the said Engineer, a layer of the broken stone of the quality and size hereinbefore specified for the bottom course, and of such a depth as will when rolled, make a course four inches thick, shall be spread evenly over the prepared sub-grade; this course is then to be rolled, first along the sides and working toward the center, until the stone is as closely fitted together as practicable, with or without sprinkling as may be directed. A sufficient amount of stone shall be added to or removed from this course to make it conform to the required grade and surface.

This course shall then be thoroughly rolled until the ten-ton macadam roller leaves no depression in passing, but no rolling shall be done when the sub-grade is so wet that the stone is forced into it.

Limestone screenings, which are to form the filler, shall then be spread uniformly by means of a spreader-wagon which can be set so as to distribute the screenings in any desired quantity over the surface of the roadway.

In the absence of such a spreader-wagon, the screenings shall be dumped in piles at proper intervals along the side of the roadway, upon the wings, with plank set on edge against stakes if necessary, to prevent the piles of screenings from sliding into the ditch. In no case shall the screenings be dumped directly upon the surface of the crushed stone.

The screenings shall be spread by the spreader-wagon or by shovels uniformly over the surface of the crushed stone in sufficient quantity to nearly cover the fragments of stone. They shall be rolled twice or thrice while dry, and the action of the roller shall be aided by rattan brooms, if necessary, so as to work the screenings down among the fragments of the stone, and to leave the surface free; filling the spaces approximately for one-half the depth of the course.

The surface shall then be thoroughly flooded with water from the sprinkler to further aid in carrying the screenings into the spaces.

After allowing this to settle, the spreading of dry screenings shall be repeated, if necessary, and again treated as described until on completion of this course the screenings shall fill the spaces to within about one inch of the surface of the crushed stone.

In case too much screenings have been spread, so as to cover and conceal the fragments of stone, the surplus must be brushed or scraped from the roadway until the fragments of stone are visible, and until the spaces are free for an inch, as above described.

The top course shall be of trap as hereinbefore described for said course. It shall be spread to such a depth as will, when rolled, make a course two inches thick. As the rolling of this course progresses, sufficient stone shall be added to or removed from this course to make it the required thickness and to bring it to the required grade and crown. This course shall be rolled until it is thoroughly compacted and the stone closely fitted together.

After rolling the crushed trap as described, limestone screenings, as above described, shall be spread, rolled and swept while dry, and then soaked with water from a sprinkler, in such manner as to facilitate the complete and compact filling of all interstices of both courses: Several successive applications of screenings being necessary to accomplish this result.

During the sprinkling and rolling, the screenings shall be swept about with brooms to facilitate the thorough filling of all interstices. Water shall be applied in such quantities as to thoroughly soak and fill the pavement so as to secure a "set." The rolling and wetting shall continue until a wave is produced before the wheel of the roller.

The rolling on both courses shall be done with a macadam ten-ton steam roller, so built that it shall exert a pressure of not less than 500 pounds to the linear inch measured across face of rollers. The amount of rolling required will not be less than 100 times over each portion of surface, and may be more than 200 times to obtain the required results. The rolling and sprinkling shall at all times proceed under the direction of and be done to the satisfaction of the Engineer in charge.

After all the interstices of the stone are filled with screenings, forty-eight hours may elapse before the final puddling, if, in the opinion of the Engineer, a better result will be obtained thereby, but nothing in this provision shall be construed as entitling the Contractor to longer time in completing his work according to the terms of this contract.

If required by the Engineer in charge, all stone shall be spread from dumping boards to be furnished by the Contractor.

SEEDING SHOULDERS.

At the time and in the manner directed by the engineer, the contractor shall seed the shoulders for a width of five feet on each side of the macadamized roadway, with lawn-grass seed of a kind satisfactory to the Engineer, using not less than thirty pounds to the mile.

UNCOVERED ENDS.

The rolling shall be prosecuted in such sections as shall be directed, and a space the entire width of the wheelway and for a length of ten feet at the end of each course shall, when practicable, remain as the work progresses uncovered by the next overlying course; and, when practicable, no rolling will be allowed within twenty-five feet of the end of any course.

DEPTH AND WIDTH OF PAVEMENT.

The pavement, when completed, shall be sixteen feet in width and shall be at least six inches in depth, as is required by the specifications, and of such crown and form of gutter as are shown on plans; and in any case the thickness on the pavement is to be determined on a line at right angles to the grade and crown.

NO ALLOWANCE WILL BE MADE FOR ANY MATERIAL DRIVEN INTO THE SUB-GRADE BY ROLLING, OR MISTAKE MADE BY CONTRACTOR IN EXCAVATING OR FILLING. The use of a proper roller, rammers or other suitable implements, is to be substituted for that of the steam roller when the Engineer so directs.

SPRINKLING.

After any section of roadbed one hundred feet in length has been completed to the satisfaction of the Engineer, it shall be thoroughly sprinkled at least once a day for a period of thirty days.

EXTRA MATERIAL FOR MAINTENANCE.

In addition to the crushed trap and screenings of limestone used in the work above specified, there shall be also provided sufficient quantities of each to form at intervals of two hundred feet piles of crushed trap and of limestone screenings; each pile to be about three feet by six feet and to be neatly formed at side of road, and to contain about one cubic yard of crushed trap and one-fifth cubic yard of screenings.

RUBBLE MASONRY LAID IN CEMENT.

All masonry called for under this particular contract will be laid in American Portland cement mortar.

This class of masonry shall be used for head-walls of all pipe-drains, and for bridge abutments.

Stone shall be sound, durable, well shaped quarry stone, free from all structural defects; either limestone, sandstone or granite of quality approved by the Resident Engineer. No stones which have been blasted with dynamite will be accepted for masonry.

Stone shall be at least six inches thick. They shall have a bed area of at least two square feet and a depth of bed of at least one and one-half times their thickness. Walls shall be coped with stone the full width of the wall.

The stones shall be laid on their natural bed in full beds of cement mortar. No spalling up under the bed will be allowed. The entire bed joints and the vertical joints for a distance of four inches back from the face of the wall shall not exceed one inch in width. The whole wall shall be thoroughly bonded together. All joints and interstices shall be completely filled with mortar, and all exposed joints shall be raked out to a depth of at least one inch and neatly pointed with mortar formed with equal parts of American Portland cement and fine, clean sand, which shall be mixed in small batches and used within thirty minutes. No mortar shall be retempered.

The dimensions of the walls shall be as shown on the plans.

EXISTING CYCLE PATHS AND FOOT PATHS.

Wherever a cycle path or foot path shall have been constructed along the road which is to be improved, said path shall be recognized by the Contractor as an existing and important work which shall not be covered, injured or obstructed unless the location is such that such path cannot be wholly avoided.

PORTLAND CEMENT MORTAR.

The mortar will be made of the best quality of American Portland cement, and clean, sharp sand, in the proportion of three parts of sand to one of cement by volume, and shall be used within forty-five minutes after mixing, or before the cement shall take its initial set. If mortar has set at all before using it shall not be retempered, but shall be thrown away and a new batch shall be mixed.

No cement will be used in any part of the masonry until the Engineer shall have approved the same. It must be delivered in tight barrels or bags, as the Engineer may direct, and thereafter be properly protected from the weather and from moisture.

The Engineer to direct in what manner the sand shall be screened and worked, and washed, if necessary.

Special directions will be given by the Engineer as to the delivery of cement and as to the time and facilities required for testing it previous to its use in the work. No cement will be used except in compliance with these directions. All facilities required by the Engineer for securing tests must be afforded by the Contractor.

All cement offered for use in any work may be sampled by an agent of the State Engineer's Department. Such samples will be collected immediately on delivery of cement at site of work, and Contractors will promptly notify the Engineer of the receipt of cement in order that no delay may be had in the sampling thereof. Samples will be forwarded to the cement testing office in Albany, and will be subjected to the following tests; and any cement failing on either of them will be rejected, though the further right is reserved to reject any and all cements, the qualities of which have not become well known through prior use in State work or elsewhere:

PORTLAND CEMENT must be of the best quality and of such fineness that ninety-five per cent. of the cement will pass through a sieve of 2,500 meshes to the square inch, and ninety per cent. through a sieve of 10,000 meshes per square inch. Portland cement, when mixed neat and exposed one day in air and six days in water, shall withstand a tensile strain of not less than 400 pounds to the square inch, and when mixed in the ratio of three pounds clean, sharp sand to one pound of cement, and exposed one day in air and six days in water, it shall withstand a tensile strain of not less than 125 pounds per square inch.

PAVING.

This will include paving at inlet and outlet of all drains, culverts and side ditches as shown on the plans. The paving shall be constructed of sound, durable, well-shaped quarry stone. Stone shall be twelve inches deep and at least four inches wide.

They shall be laid in line and grade, as directed by the Engineer, on a foundation of six inches of clean, coarse sand or fine gravel, and shall be thoroughly rammed with a heavy rammer. After ramming, the joints of the paving shall be swept full of coarse sand or fine gravel, and the entire surface of the paving shall be covered to a depth of one inch with sand or gravel.

CULVERTS BENEATH DRIVEWAYS: CAST IRON PIPE.

Where the side ditches must be carried beneath driveways and road crossings, culverts shall be of cast iron pipe of sizes and lengths shown on plans.

The pipe may be of second quality, but must be cast in dry sand moulds placed vertically, and truly centered. The iron must be of good quality, uniform in thickness and full strength, coated with coal-pitch varnish mixed with linseed oil to form a firm, tough coating.

The joints shall be made by placing a gasket of oakum, and filling hub with mortar formed of equal parts of American Portland cement and clean sharp sand.

The back-filling around the pipe shall be thoroughly tamped under, around and over the pipes and the driveways and road-crossings left in good condition, as provided in section 7 below.

TIMBER AND PLANKING.

Timber and planking shall be used as shown on the plans and as directed by the Engineer. All timber and planking shall be of a kind shown on the plans, sound and free from sap, shakes, bad knots or decay.

ENGINEER'S ESTIMATE OF QUANTITIES.

Excavation (of which cubic yards are to be put in place), cubic yards.

Broken stone macadam foundation (rolled in place), cubic yards.

Broken trap rock macadam top (rolled in place), cubic yards.

Extra for maintenance, cubic yards.

Lime stone screenings, cubic yards.

Extra for maintenance, cubic yards.

Brick lined wells with gratings, wells.

Rubble masonry, including coping, cubic yards.

Lining under pipes and paving, cubic yards.

Paving, cubic yards.

Vitrified pipe, 12 inches diameter, feet.

Cast iron pipe, 10 inches diameter, lbs. (ft.); cast iron pipe, 12 inches diameter, lbs., per 12 ft. length, laid complete (ft.); cast iron pipe, 16 inches diameter, lbs. (ft.); cast iron pipe, 18 inches diameter, lbs., per 12 ft. length, laid complete ft); total, lbs.

Seeding wings, about acres in area, lbs. seed.

NOTE.—The following approximate quantities of crushed stone and screenings will be required to form the roadway "rolled in place" as above stated; the surface of the macadamized roadway being equal to about square yards. Broken stone for foundation, loose in bin, cubic yards; broken trap for top, loose in bin, cubic yards; limestone screenings for filler for both courses, cubic yards.

It is, however, distinctly understood that the Contractor must satisfy himself regarding the conditions governing all the work to be done, and as to the nature and extent of all the materials required to make the work conform, in all respects, to the plans and specifications, it being further distinctly understood that the State or party or parties of the second part do not guarantee the correctness of the quantities above stated, although care has been taken in preparing same, and that whether these quantities are increased or diminished no sum will be paid therefor in excess of the lump sum named in the contract, unless the plans or specifications shall have been changed as provided for in articles 5 and 6 of the "General Clauses" of this specification.

CLAUSES OF GENERAL APPLICATION.

1. The plans and specifications are a part of the contract and will be held to cover any and all work that could be reasonably inferred as needed, taking the two together for a complete and workmanlike job. Work shown on the plans and not mentioned in the specifications or vice versa will be done the same as if shown by both, when and where required.

2. All work will be neatly cleaned up on completion, according to the Engineer's directions, and be left in a neat and orderly condition ready for use.
3. The Contractor hereby assumes all risks and liabilities for accidents or damages that may accrue to persons or property during the prosecution of the work, by reason of the negligence or carelessness of himself, his agents or employes.
4. The successful bidder shall satisfy the State Engineer, before the contract is awarded to him, that he has, or will promptly provide suitable and proper men, and all tools and machinery for each of the different kinds of work; which tools and machinery shall be kept upon the work during the entire time that it is in progress.
5. Should any work be required, that in the judgment of the State Engineer is not included under these specifications, or not covered by the prices named in the contract, such work shall be done pursuant to the State Engineer's written direction, after a price therefor shall have been agreed upon.
6. The right is reserved to make such changes in the plans or specifications as may, from time to time, appear necessary or desirable, and such changes shall in no wise invalidate this contract. Should such changes be productive of increased cost to the Contractor, a fair and equitable sum therefor, to be agreed upon before such changed work shall have been begun, shall be added to the contract price, and in like manner deductions shall be made.
7. The Contractor shall, without extra compensation, grade a safe, proper and workmanlike connection with all intersecting public or private roads or driveways, according to the Engineer's directions
8. The work shall progress in such manner and at such times as the Engineer may direct.
9. All material which may be rejected shall at once be removed from the vicinity and replaced by material of approved quality.

10. The Contractor shall give his constant personal attention to the work while it is in progress, or he shall place it in charge of a competent and steady foreman who shall have authority to act for the Contractor, and who shall be acceptable to the Engineer; the Contractor shall at all times employ sufficient number of workmen for the proper performance of the several works which he shall prosecute to full completion in the manner and time specified. Any workman whom the Engineer may deem incompetent or unfit for duty shall be at once discharged.
11. Should the Contractor at any time fail or refuse to comply with these specifications, the State Engineer, three days after giving written notice to the Contractor, may purchase necessary materials and employ proper workmen and perform the work; the cost of such materials and labor being deducted from the contract price, as the State Engineer may decide.
12. Wherever the word "Engineer" is used in these specifications, it is understood to mean the State Engineer and Surveyor or his representative in charge of the work.

COMMENCEMENT OF WORK.

Work must be started within ten days after the signing of the contract.

PROGRESS AND COMPLETION OF WORK.

The work shall continue until about November 15, , and will then close for the winter when ordered by the State Engineer and Surveyor. Special care being used to complete during such portion of the road as may be worked upon. Work shall be resumed about May 1, , at the order of the State Engineer and Surveyor and shall be completed by June 15, .

In case the work is not completed by the above date, and the Contractor requests an extension of time, such request shall only be granted with the condition that the Contractor shall pay all the expenses of engineering and inspection from the above date when the contract should be completed to the date when it is actually completed and accepted by the Engineer.

In case the work is completed before the above date, the contract price to be paid shall be increased one dollar per mile of road thus built.

SPECIAL.

The Contractor will conform to all the provisions of chapters 415, 416 and 444 of the laws of 1897, and chapter 567, laws of 1899, to which special attention of bidders is called regarding rates of wages, hours of labor and times of payment of employes, and the sub-letting of contracts.

INSTRUCTIONS TO BIDDERS.

1. Bids will be made upon the blank form which follows these specifications: which specifications with the original bid, will be attached to and form a part of the contract.
2. Each bid shall be accompanied by a New York draft or a certified check, payable at sight to the order of the State Engineer and Surveyor for 5 per cent of the amount of the proposal; which check shall be held until the execution of the contract.

   The successful bidder who fails to enter into contract will forfeit his check.

   When the contract has been made, the various checks will be returned to the bidders who deposited them.
3. The successful bidder must furnish bonds for the faithful performance of the work as provided for by law; each bond shall be for the full amount of the contract, and shall be signed by two responsible parties, each of whom shall certify that he is worth double the amount of the bond over and above all liabilities; each bond must be signed by the principal and both sureties.
4. Each signature to proposals, guarantees, contracts and bonds shall be written out in full, and each signature to guarantees, contracts, and bonds shall be attested by a witness and shall have affixed an adhesive seal.

5. The place of residence of every bidder, and post office address, with county and state, must be given after the signature.
6. One copy of the advertisement, as published in the local paper, must be securely attached to, and will be considered as forming a part of, each proposal.
7. All blank spaces in the proposal and bond must be filled, and the addition in writing of any condition, limitation or provision will be liable to render the proposal informal and to cause its rejection.
8. No bids will be received after the time set for opening them.
9. The State Engineer and Surveyor reserves the right to reject any or all bids, and to disregard the proposal of any failing contractor.
10. Bidders are invited to be present at the office of the State Engineer and Surveyor in Albany when the bids are opened.

Proposal—Road No. , State of New York, Public Highway Improvement, Road, Co., N. Y.

CHAPTER 115, LAWS OF 1898.

To the State Engineer and Surveyor of the State of New York:

The undersigned, resident of the .... of .... county of ...., hereby propose to improve, in accordance with the plans, specifications and form of contract prepared therefor by said State Engineer and Surveyor,......miles of the ....road between the................and the village of........, in the town of......., ...county, N. Y., for the sum of .... dollars and .... cents, said sum to be in full compensation for all work, labor and materials required to complete said work according to the meaning and intent of said plans, specifications and contract, and on the acceptance of this proposal for said work, do hereby bind .... to enter into written contract with the said

State Engineer and Surveyor at such time and place as shall be required by him, and to give the required bond and surety, signed by at least two other responsible persons, to perform said work for the consideration above named.

Dated at .... the ....day of ....190..
.... P. O. Address...................
.... County of......................
.... P. O. Address...................
.... County of......................

It will be seen that the present "good roads" law makes scant provision for the proper maintenance of roads built with state aid. It simply provides that after completion their maintenance shall be a county charge. Too much stress cannot be laid on the proper maintenance and intelligent supervision of these roads after they are built, and in this matter we should be guided by the experience of other states and countries that have evolved more or less satisfactory plans only after many years of costly experiments.

Such experiments and experience have crystalized opinion on one great point, viz.: *that supervision and maintenance, to be most effective and economical, must be intelligent and CONSTANT.*

It therefore follows that so far as these state aid roads are concerned, our usual methods of providing for road maintenance must be somewhat radically changed. It is well known that such methods do not now produce satisfactory results and there does not seem to be any good reason to expect that these same methods when applied to the new roads will be any more satisfactory. Therefore this department adheres to the belief that the towns or counties, or both, in which these roads are built, should provide for proper care takers in such manner as may seem best, and that such care takers should be governed in their work by the directions of this department. Failure on their part to conform to proper and intelligent directions, or the wilful doing of improper work that would injure these roads, should be punishable to such extent as to be effectively prevented. It should be as much of a crime to destroy a good road as it is to destroy any other valuable property.

Good roads are economical, but the economy is largely secured by proper maintenance.

If the difference between the cost of maintaining the good roads and the present poor roads is enough to more than pay the interest on the cost of the good roads, then the good roads are also desirable from a financial point of view. Such results, and better, have been accomplished in many localities and the rule can, and should be, made applicable to the whole State.

The present cost of maintaining(?) our poor roads is enormous, and it is wasteful because it produces no satisfactory results.

Attention is called to the money or commutation method of providing for highway work, as compared with the usual day labor plan. The former enables the highway commissioner to plan his work intelligently, spend his allotted sum economically, and get value received therefor. The latter is quite apt to result in having the work done at improper times and by men unskilled in such work, and its results are unsatisfactory from every point of view.

Every town should, therefore, adopt the money system of road maintenance. This would prove a vast step toward general road improvement, and it can easily be done, at any town meeting, on the petition of twenty-five taxpayers.

Good Road Leagues have been formed in some counties in this State, having for the object of their organization the betterment of the roads, and have succeeded admirably in furthering their desires. I should earnestly advocate the formation of similar societies in every county, as concerted and combined effort will surely attain the object sought. For that reason I also suggest a free interchange of opinion between this Department and the various leagues.

The State Engineer holds himself in readiness to attend any meeting in the cause of good roads, and in any county which may desire his presence for the purpose of mutual understanding of the needs of any particular locality.

All inquiries upon the subject of Road Improvement will be gladly responded to, and any suggestions relating thereto will receive careful consideration and reply.

If space permitted, a great many statistics could be given here to show the necessity of good roads to every inhabitant of this State; but I do not believe that any arguments are needed, and in this bulletin I have simply endeavored to call your attention to a few points, trusting that all of our citizens will appreciate the fact that individual and united effort on their part will be required to bring this matter of good roads to a point where it will receive the attention from the Legislature which it deserves.

EDWARD A. BOND,
State Engineer and Surveyor.

Improvement of Public Highways.

BULLETIN NO. 2—OCTOBER, 1899.

(Referred to the State Engineer and Surveyor's Report as Appendix B.)

The cordial reception accorded the first Bulletin on "Good Roads" issued by this Department, encourages me to continue the subject, and submit my second Bulletin to those interested in this work.

Having dealt almost entirely with the construction of roads in my first paper, I deem it advisable to devote this bulletin to their maintenance. It is a subject of such vital importance to the life of a macadam road that too much cannot be said concerning it.

It will be well in the first place to note the difference between the words "repair" and "maintenance."

Repair means to restore a road which has been neglected, and has suffered in consequence, to its original condition. Maintenance means to preserve that original condition, and ward off the necessity of repairs. Roads in the country are continually subjected to the action of the elements, the wear of the wheels and horses' feet, and the continual pounding it receives from passing loads. Therefore, after a road has been accepted by the State Engineer as completed, and turned over to the officers of the county, it is then that the duties of these officers really commence, and it depends on their efforts as to what the life of the road will be; whether they will spend the money wisely on *maintenance*, or if they will allow the road to deteriorate and make expensive *repairs* necessary.

As no provision has been made in the Higbie-Armstrong bill for such maintenance, aside from the provisions in section 13: "All persons owning property abutting on such road so improved, or residing thereon, shall thereafter pay all highway taxes assessed against them in money, in the manner now provided by law," it may be well to consider the various methods in vogue by which roads can be kept from deteriorating.

This subject is so well understood in European countries that we need look no further for the cause of the excellence of their roads.

Three systems exist:

1st. By contract with private parties.

2d. By the aid of the rural population, and

3d. By men employed for that purpose by the community.

Of these three, only the third proposition is the proper one. This is the system used in France and Germany; the objection to number one being, that it has been tried and found wanting; to number two, that any aid given by the rural population is not applicable to the maintenance of an improved road, as such a road needs the supervision of a man perfectly familiar with this class of work, and such a one can only gain this familiarity by being constantly and permanently employed. Men who have been given charge of a piece of road soon become interested in it, and will strive energetically and intelligently to make their portion of the road the best. It would seem advisable, therefore, that the third proposition should be adopted by the supervisors of the county in which the improved road is situated. That is, a man should be appointed and employed permanently, who should have the road or a certain portion of it in his charge, and who, under the supervision of the officers of the county, should be responsible for its maintenance.

The total points in the care of a road are as follows:

1st. Keeping the surface of the road free from all deposits, dust or mud, horse manure or other rubbish.

2d. Filling of ruts and depressions.

3d. Cleaning ditches and seeing that all culverts and water courses are free from obstructions.

4th. Sprinkling the road in dry weather.

To properly carry out these absolutely necessary operations, it is, of course, necessary for the county officers to supply their roadman with the necessary appliances and tools.

After a road has been handed over to the care of the supervisors, they should immediately order a sufficient quantity of material to be used in filling ruts and depressions. They will, therefore, need trap rock and limestone screenings. It will cost less per mile of road kept one year on this system than it will under the old and bad system of semi-annual or annual repairs. Without continual attention there can be no such thing as a permanently good road. This material should be placed in regular piles or storage places along the side of the road, say 200 to 250 feet apart, but in no case should the material lie on the road or encroach upon it.

The quantity of material to keep a certain stretch of road in constant care varies very much, as it depends largely upon the intelligence with which the filling is done, and on the amount of travel on the road. For a width of road—16 feet the average quantity to keep a stretch of 16½ feet (1 rod) in repair has been given in the following table:

Good material and heavy travel..........	.073 to .097 cu. yds.
Good material and medium travel.........	.049 to .073 cu. yds.
Good material and light travel............	.024 to .049 cu. yds.

It would appear, therefore, that a mile of road of good material with heavy travel would need about 32 yards of material per year, as the above quantities are ample, piles of stone placed 200 feet apart, say six feet long, three feet wide and one and one-half high, would be ample to supply all needs. Such a pile would contain one cubic yard and could be easily measured at all times. By spacing them 200 feet apart, twenty-six of such piles to the mile would suffice.

The next thing to be purchased by the supervisors is a kit of tools to be used by the man in whose care the road is placed. He should be furnished with a wheel-barrow, a pick, shovel, brush-broom, hoe, rake, profile board, level, line, bush-hook, spade, four-pound hammer, and a road rammer about seven inches in diameter and weighing about fourteen pounds. Every road should have a roller, and if the length of the road does not justify the purchase of a steam roller, one drawn by horses should be used.

The horse roller should weigh not less than four tons and the steam roller not less than ten tons.

The weight per inch of width is more important than the gross weight of the machine, and roller should be built so as to exert a pressure of not less than 500 pounds to the lineal inch, measured across face of rollers. A sprinkling cart is also one of the necessary adjuncts of a well-kept road, as the tendency of the road to ravel in dry weather may be quickly arrested by the judicious use of water.

Having thus enumerated the articles necessary to the keeping of an improved road it will not be amiss to quote extracts from instructions to roadmen by prominent authorities. Byrne in his "Highway Construction," says:

"The disintegrating action of the weather and the friction of the traffic produces dust; this dust renders the road heavy for traffic and annoys passengers and horses. If rain falls the dust is converted into mud. A well-swept road produces no mud after a rain, at least not for several days. However, if the humidity increases, the road surface becomes at first sticky and finally is covered with mud. Mud makes the tracks of wheels apparent; other vehicles follow in them, and after a while ruts are formed which injure the road. Thus it is essential that the dust and mud be removed by sweeping and the mud by scraping. These sweepings and scrapings should not be left on the sides of the road to be redistributed by the first wind, but should be immediately removed. They might be used by the farmers as an adjunct to their manure pile.

1. The best time for sweeping is early in the morning before the dew has dried.

2. Daily attention must be given to the making of slight repairs, such as filling ruts and depressions; for however well material may be laid and rolled, the traffic will search out the places which are weak and have escaped the full pressure of the roller.

(*a*) All ruts should at once be filled. The traffic is thus slightly diverted, as a horse will avoid new metal.

(*b*) Depressions and hollows should be filled at once. The surface of the road should never be allowed to lose its regular section.

(*c*) If the surface of the road where these patches are to be placed is very hard, it must be loosened up with the pick.

(*d*) Water lodging in a depression should not be let off by digging a trench with a pick-axe to the side of the roadway. The depression should be filled up.

(*e*) All loose stones to be picked up at once and stored for use in filling hollows. If allowed to remain, they are not only dangerous to horses, but are liable to be crushed or to be forced through the skin of the roadway, thus causing damage.

3. At all seasons of the year the gutters should be kept free from mud or rubbish; and anything that impedes the free discharge of the rain-water from the surface of the road must be removed.

The ditches and culverts should be well cleaned out in advance of the spring and fall rains. In northern localities where snow lies for some time, the outlets of all ditches and culverts should be opened and cleaned out before the spring thaws set in. In the fall, all weeds and grass in the ditches should be cut and all culverts and water outlets left in good shape for winter.

4. Watering to lay the dust is essential in summer and occasionally in winter.

In summer, during the dry, hot weather, the road surface becomes extremely brittle and then should be watered, the dust and refuse having been first removed. Sometimes, in winter especially, after a frost, the road gets very sticky and picks up freely under passing wheels. It should then also be watered and all slush removed. When dust is regularly removed from the road, it does not require so much watering in dry weather as it otherwise would. A road should never be watered unless it really needs it, as too much water is injurious and it increases the wear from traffic."

I also quote extracts from the *Engineering Record* in regard to continuous system of repairs to roads:

" Inasmuch as the covering gradually wears off, notwithstanding all precautions, it must be renewed, and should be so renewed gradually, in the same measure as it wears off. The best time to put on new road metaling is during continuous wet weather.

In filling up holes, the bottom of the same is to be swept clean of mud, then filled up level with the remainder of the road, not in a heap so high above it as to obstruct travel. Every care should be taken to have the new material join as speedily as possible with the old portion of the road, and it should be so well laid that it will give the least possible hindrance to vehicles, which will then not avoid the patched places.

When many ruts occur in a short distance, the deepest only are to be filled first. After the patching in these has become solid, then the rest are to be attended to. Long ruts or wheel tracks are not to be filled up the whole length at once, but only short pieces at a time. If this precaution is neglected, vehicles avoid such places and new ruts are formed elsewhere.

Inasmuch as more material is worn off in a dry season than can be put on, there are then, when wet weather comes, large places to be repaired. These must be mended by degrees, never filling up a piece larger than eight to ten feet by four to seven feet at a time and not having these pieces too close together; when these become solid, then some more may be filled in and so on till the whole is done.

Should it, however, become absolutely necessary to repair a piece of road in dry weather, the place where the new macadam is to be deposited, must be loosened with a pick, then the new material put on and a solid top formed by the use of binding material, sprinkling of water and rammings. Should a frost or very dry weather occur immediately after macadam has been put on the road in wet weather, so that the same will not join on to the rest of the road surface, the whole must be removed, cleaned and returned to the storage heap for future use. A layer of macadam over the whole road should never be put on without treating it immediately in the manner described in the specifications for new roads.

The earthen wings are to be kept in repair by excavating the earth required from the side ditches and well rammed. The double object is attained of keeping the ditches and the wings of the road in proper shape and condition."

The foregoing instructions apply to macadam pavement exclusively, but the treatement of a gravel road varies little, if any. Keep your ditches and water courses clean, sprinkle the road judiciously and fill up ruts and depressions.

The supervisors should be careful that no size of stone is used of larger proportions than that which has been used in the construction of the road, namely: For bottom course, stone broken in sizes varying from 1½ inch to 3 inches in their longest dimensions; for top course, stone broken in sizes varying from 1¾ inch to 2 inches in their longest dimensions.

Special care should be taken that no large stone creep in. A good rule is Macadam's advice, that any stone that you cannot easily put in your mouth should be broken smaller.

It should be well borne in mind, that sooner or later as the good roads increase under the Higbie-Armstrong act, some system of maintenance must be devised, and that even at the present time the few stretches that have been completed must have the same zealous care, as if a certain network of roads were completed. Therefore a caretaker should be appointed at once, as soon as the completed road has been delivered over to the supervisors. The question also arises whether the cost of maintenance of a stone road is greater or less than the amount used on the same unimproved road. The general answer is that the balance will be in favor of the stone road, but this will have to be proved and this can only be done by keeping a careful account of all expenditures, from the very outset.

Naturally, a competent man should be chosen by the supervisors, and I am inclined to favor the propostion made in circular No. 30 of the U. S. Department of Agriculture, published March 1, 1898, which is as follows:

"Probably it is too soon to expect the matter to be reduced to a system which would keep the cost of repairing stone roads separate from other charges, so that the cost of each year on each road could be known. The taxpayer, who furnishes the money, has a right to know just how his money is expended, and public officers having charge of the repairs of roads should be obliged to keep correct accounts and publish the same annually for the information of the taxpayer. If an officer is not competent to do this he should not be retained in office. In States granting State aid, the law should make obligatory for county officials to put the matter of road repair under the supervision of competent persons to be approved of by the State officer in charge of road system. The county officer in charge of roads should be compelled to make a report to him and state the cost of repairs on each road separately. Among the advantages of this might be mentioned:

1. It would place the responsibility of road repairs for the county upon one person, and he would be more likely to be selected for his ability to perform the duties, keep the accounts, and make up an intelligent report.

2. It would enable the taxpayers to see what repairs cost, and by comparing the cost of repairs of one road with another, and of one county with another, they could form an idea as to the economy or extravagance used in road repairs.

3. The cost of all repairs on roads built under State aid would be information very valuable to those interested in road improvement, as well as those having charge of roads.

The county officer having charge of the road could not be expected to look after the details of repairs on all roads. The plans adopted by the old turnpike corporations seem to be the most practical. Let the roads be divided into sections of from three to six miles each, the county to furnish the material for repairs and place the same at convenient points along the road. The person appointed to keep the road in repair should be paid by the year for putting on the material, cleaning outside ditches and culverts, and keeping the road in repair as required by the county engineer. He would then soon learn that it would be to his advantage to go over the road after every hard rain or shower and remove any obstructions found in the ditches that would divert the water so that it would be liable to make a wash. He would also see any hole or depression in the road surface and immediately fill it. In fact, he would soon find the wisdom of "a stitch in time saves nine," and the road would be kept in constant repair at a comparatively small cost. It might take a few years of experience to fix the proper amount to be expended in each section, but it would soon adjust itself. There are always persons living along or near the line of these improved roads who will be willing to "take their chances" in getting something out of the job. Persons will be found also who will take a pride in keeping their section in good order, so as to receive the commendation of the public; and particularly when they find, as they soon will, that "an ounce of prevention is worth a pound of cure," and that a road attended to on this plan, and on which repairs made promptly when they are needed, costs much less, on the whole, than one which is neglected. Too much pains cannot be taken to keep improved roads in constant good repair, as it will add comfort to those who use them, save the wear and tear of horses, harness and wagons, and save very much in the general cost of maintenance."

WIDE TIRES.

As the foregoing pages cover nearly everything pertaining to the maintenance of improved roads in a general way, although page upon page could be written on the subject and its urgency without exhausting it, I think enough has been said to furnish material for thought upon this theme, and it seems advisable to say some few words on the subject of wide tires on vehicles, used on these improved roads. Laws have been passed in this and other States, but have failed to reach the desired result. It seems to me, the better way is to appeal to the intelligent farmer, showing him the advantage of the use of wide tires in connection with the improved roads. He will soon grasp the situation and will order wide tires when new vehicles are ordered; and if there are still some few malcontents who will not be convinced under any circumstances, let a law be passed compelling these few to adopt them.

Many tests have been made to establish the claims in favor of wide tires as against the narrow ones, and a few of the results are given as stated in bulletin twelve of the United States Department of Agriculture by General Roy Stone. In Utah, at the experiment station, it was shown that a given load on 1½ inch tire pulled 40 per cent. heavier than when on a 3-inch tire, the test being made on grass sod. On a moist, but hard road, the percentage was 12.7 in favor of the 3-inch tire. In Ohio a wide tire test was made at the State University. An ordinary wagon with a new 3-inch tire was loaded with two long tons, or 4,480 pounds, and the draft measured by a dynamometer. On an ordinary earth road, in good condition and hard, the draft was 254 pounds. On a grass field it was 468 pounds. On a newly plowed field it was 771 pounds. As 150 pounds is the draft of an ordinary horse of 1,000 pounds, two horses could draw this load with ease on an ordinary road, and a ton and one-half on a grass sod; while with a narrow tire one-half as much, or a single ton, is a full load for a double team. Besides this, the broad tires roll and level a road so that the more they are used the better the road becomes, while narrow tires cut it into ruts, if it is at all soft.

Professor Sanborn, of the Missouri Agricultural College, tried the same experiment with wagons having tires of different widths, using a Baldwin dynamometer. The weight of the load drawn was 3,665 pounds each. The tires were 1½ inches and three inches respectively. The tests were made on blue grass sod partially moist. The draft of the wide tires averaged for level ground 310 pounds. For the narrow tires the draft was

439 pounds, or 41.6 per cent. more than the wide tire. Assuming the wagon to weigh 1,000 pounds, then on the broad tire 3,248 pounds would be drawn as easily as 2,000 pounds on the narrow tires. Again, the broad wheels in the trial did not injure the turf, while the narrow wheels cut through it.

The following report is made by the Vermont highway commission:

"If the present law was so amended as to limit the allowed weight per inch of tire to a definite number of pounds, we believe this would best accomplish the desired result. To determine what this limit should be, we have measured and weighed a large number of wagons representing a great variety of the heavier traffic in the State, and have concluded that the maximum weight, including wagon, allowed per inch of tire should be 550 pounds. This is higher than that placed by most authorities, but far less than the average on city pavements. The following table shows the load, including the weight of wagon, that could be carried under such a regulation on varying sizes of tires."

Width of tire in inches.	Allowed load, including weight of wagon, pounds.	Width of tire in inches.	Allowed load, including weight of wagon, pounds.
2	4,400	3½	7,700
2¼	4,950	3¾	8,250
2½	5,500	4	8,800
2¾	6,050	4½	9,900
3	6,600	5	11,000
3¼	7,150	6	13,200

For vehicles with suitable springs, the allowed load could probably be increased one-third.

It will be seen, therefore, that the wide tires are not only lighter in their draft than narrow ones under nearly all conditions, but they cut up the road very little; in fact, when 6 inches wide they tend to make the road continually better.

That this subject has had the closest attention paid to it in Europe is proven by the regulations adopted in the various countries as reported by the United States Consuls.

In Austria all wagons built for a load of more than 2¼ tons must have wheels with rims at least 4 1-3 inches wide (Styria and Carinthia), and if built for more than 4½ tons (in Styria) or more than 3½ tons (in Carinthia) the rims must be at least 6¼ inches broad. In lower Austria a width of rim of 4½ inches is required for loaded wagons drawn by two or three horses. In Bohemia the same regulation applies.

In France every freight and market wagon is a roadmaker. The tires are from 3 to 10 inches in width, usually from 4 to 6. With the few four-wheeled vehicles used the tires are rarely less than 6 inches in width, and the rear axle is about 14 inches longer than the fore axle, so that the rear or hind wheels run about one inch outside of the level rolled by the front wheels.

In Germany the rule prescribes that all the wagons drawing heavy loads such as coal, brick, earth, stone, etc., must have tires at least 4 inches wide.

By carefully noting these regulations, one will see that in the European countries they have long ago discarded the narrow tires, much to the advantage of their roads and the saving of their horses and vehicles; and it is to be hoped that the American farmer after digesting these statements, will see the advantage of such a self-evident propostion and follow their example.

FORMS.

In order that the provisions of the law providing for the preliminary steps to be taken for the improvement of highways by State aid, may be fully complied with, and for the convenience of petitioners for such improvement and the boards of supervisors presenting resolutions, I append hereto blank forms covering this subject.

Form "A" is the petition to be presented by property owners to the board of supervisors asking for improvement of the highway.

" B " is the certificate to be attached to said petition.

Form "C" is the resolution to be adopted by the board of supervisors in cases where property owners present petitions to the board asking for such improvement.

Form " D " is the resolution to be adopted by the board of supervisors in cases where *no* petition is presented by the property owners.

Form " E " is the final resolution to be adopted by the board of supervisors upon presentation of plans, specifications and estimate of the cost of the proposed work, whether said work is called for by petition of property owners, or upon resolution of the board of supervisors only.

The resolution covered by Form " F " should also be adopted at the same time that the resolution covered by Form " E " is adopted, providing the improvement is undertaken upon a resolution of the board of supervisors only.

The resolution covered by Form " G " should be adopted in connection with Form " E " in cases where the improvement is called for by petition of the property owners.

In some cases it is necessary to procure a right of way, in which case the resolution covered by Form "H" should also be adopted by the board of supervisors in connection with the resolution covered by Form " E."

It is suggested that the above forms be carefully followed in all cases, thus facilitating the progress of the various steps preliminary to the prosecution of the work.

EDWARD A. BOND,
State Engineer and Surveyor.

APPENDIX.

"A."

FORM TO BE USED IN PETITION FOR THE IMPROVEMENT OF HIGHWAYS TO BE PRESENTED TO THE BOARD OF SUPERVISORS BY A MAJORITY OF THE PROPERTY OWNERS.

To the Honorable the Board of Supervisors of........County:

The undersigned respectfully represent:

First, that they are the owners of a majority of lineal feet of real estate fronting on the following public highway, within the county of............Town of........and described as follows:

....

....

....

being a distance of about............miles.

Said road above described being known as the..............

.... road.

Second, believing that public interest demands the improvement of that section of said highway, described as follows: ....

....

We respectfully petition your honorable body to pass the necessary resolution, requesting that such highway be improved under the provisions of chapter 115 of the Laws of 1898.

Name of Property Owners.	**Frontage in lineal feet on property described.**
(Write names here.)	*(Number of feet here.)*

"B."

IN CASES WHERE THE PROPERTY OWNERS PETITION THE BOARD OF SUPERVISORS FOR THE IMPROVEMENT OF HIGHWAY, THE FOLLOWING CERTIFICATE SHOULD BE ATTACHED TO THE PETITION, BY THE CLERK OF EACH TOWN THROUGH WHICH PASSES THE HIGHWAY DESIRED TO BE IMPROVED.

This certifies that I have examined the annexed petition, and have compared the names of the signers thereto, with the description of the property as shown upon the assessment rolls of said town of................county of................N. Y., for the year.........., and I do hereby certify that the persons signing the annexed petition, are the owners of a majority of the lineal feet fronting on that part of....................road in the town of...........referred to and described in the annexed petition.

Dated....................

Witness to signature,

....

.... *Town Clerk of the Town of.....*

County of..........N. Y.

"C."

FORM OF RESOLUTION TO BE ADOPTED BY THE BOARD OF SUPERVISORS IN CASES WHERE PETITION IS MADE BY THE PROPERTY OWNERS FOR THE IMPROVEMENT OF HIGHWAY.

Whereas, On the............day of..............19.., there was duly presented to this Board, pursuant to sections 1 and 2, of chapter 115, of the Laws of 1898, a petition from the property owners of a majority of the lineal feet fronting on the section of a certain highway, situate within the county of............, and which section is herein described, setting forth that the petitioners are such owners, and asking that said section of the highway be improved, under the provisions of the act referred to; and

Whereas, Such description does not include any portion of the highway within the boundaries of any city or incorporated village; therefore, *Resolved,* That public interest demands the improvement under the provisions of chapter 115, of the Laws of 1898, of the section of that public highway situate in the county of..........and described as follows:...

....

being a distance of about..............................miles.

Resolved, That the clerk of this Board is hereby directed to forthwith transmit a certified copy of the foregoing resolution to the State Engineer and Surveyor.

STATE OF NEW YORK,
.... County.
Office of the clerk of the Board
of Supervisors.
} *ss.:*

This is to certify that I,.......................clerk of the Board of Supervisors of the county of.............have compared the foregoing resolution with the original resolution now on file in this office, and which was passed by the Board of Supervisors of said county of..........on the..........day of................, and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of the Board of Supervisors this..........day of..........
19.... ....

Clerk of the Board of Supervisors
of...........County.

"D."

FORM OF RESOLUTION TO BE ADOPTED BY THE BOARD OF SUPERVISORS WHERE NO PETITION IS PRESENTED BY THE PROPERTY OWNERS.

Whereas, At a meeting of the Board of Supervisors of........ county, N. Y., held in the............of................on the ....day of.............19.., a quorum being present and a majority voting in the affirmative, the following resolution was adopted:

Resolved, That public interest demands the improvements under the provisions of chapter 115, of the Laws of 1898, of that section of public highway situate within the county of .... and described as follows...

....

being a distance of about..............................miles.

The above description does not include any portion of a highway within the boundaries of any city or incorporated village.

Resolved, That the clerk of this Board is hereby directed to forthwith transmit a certified copy of the foregoing resolution to the State Engineer and Surveyor.

STATE OF NEW YORK,
.... County.
Office of the clerk of the Board
of Supervisors.
} *ss.:*

This is to certify that I,......................., Clerk of the Board of Supervisors of the said county of............have compared the foregoing copy of resolution with the original resolution now on file in the office, and which was passed by the Board of Supervisors of said county of..............on the............ day of..............19...., and that the same is a correct and true transcript of such original resolution and the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of said Board of Supervisors this........ day of.......... 19....

....

Clerk of the Board of Supervisors
of the County of............

"E."

FORM OF FINAL RESOLUTION TO BE ADOPTED BY THE BOARD OF SUPERVISORS APPROVING AND ADOPTING THE PLANS, SPECIFICATIONS AND ESTIMATE OF COST OF THE PROPOSED IMPROVEMENT AFTER THE SAME HAVE BEEN PRESENTED BY THE STATE ENGINEER AND SURVEYOR.

1. *Whereas,* At a meeting of this Board held on the.......... day of............19...., a resolution was adopted that provision should be made for the improvement of that portion of the highway commonly known as.............., and described as follows:..

....

in accordance with the provisions of chapter 115, of the Laws of 1898; and,

2. *Whereas,* The State Engineer and Surveyor has investigated and determined that a section of said highway is of sufficient public importance for improvement in accordance with the provisions of said chapter 115, and has certified his approval of the said resolution adopted by this Board on the said............day of ....19.... and,

3. *Whereas,* Said State Engineer and Surveyor has caused a section of said highway, which section is described as follows:

....

....

to be surveyed and mapped, and has caused plans and specifications and an estimate of cost to be made for said improvement, and has transmitted the same to this Board;

4. *Resolved,* That the highway known as the................ road above described in paragraph one, be improved and constructed in that portion thereof above described in paragraph three in accordance with the maps, plans, specifications and estimate prepared for such improvement by the State Engineer and Surveyor under the provisions of chapter 115, of the Laws of 1898. That said work be done under the charge, care and superintendence of the State Engineer and Surveyor, and that said

maps, plans, specifications and estimate prepared by said State Engineer and Surveyor for said work, are hereby duly approved and adopted by this Board.

5. *Resolved*, That the treasurer of the county of.............. is hereby authorized and directed to pay upon the requisition or draft of the State Engineer and Surveyor the sum of.......... dollars ($............), being one-half of the estimated expense, which amounts to $.......... for improving and constructing in accordance with the provisions of chapter 115, Laws of 1898, the section of..................road as described in paragraph three, from any unappropriated funds in his hands; and if he should find it necessary, he is instructed and directed to issue the note of the county for such a sum as is necessary to meet such requisition or draft, and said sum is hereby made available, subject to the draft of the State Engineer and Surveyor.

I hereby certify that the above is a true copy of the resolution passed by the Board of Supervisors of..............County, at a meeting held on the................day of................. 19....

....

Clerk of the Board of Supervisors.

(Attach seal here.)

"F."

FORM OF RESOLUTION TO BE ADOPTED BY THE BOARD OF SUPERVISORS IN CONNECTION WITH FORM "E," IN CASES WHERE THE IMPROVEMENT OF HIGHWAY HAS BEEN UNDERTAKEN UPON A RESOLUTION OF THE BOARD OF SUPERVISORS ONLY, AND *not* UPON THE PETITION OF THE ADJACENT PROPERTY OWNERS.

Resolved, That of the total estimated cost of said improvement amounting to $.........., thirty-five per cent. thereof amounting to $............shall be paid by the county of............ and said 35% ($............) together with the accumulated interest thereon, shall be inserted in the general tax levy for the year............; and that fifteen per cent. of said total, amount-

ing to $.............shall be paid by the town of.............
and said 15% ($............), together with the accumulated interest thereon, will be added to the amount of tax to be raised in said town of..................in the levy of..................

I hereby certify that the above is a true copy of the resolution passed by the Board of Supervisors of..............County, at a meeting held on the................day of................
19....

....

Clerk.

(Attach seal.)

"G."

FORM OF RESOLUTION TO BE PASSED BY THE BOARD OF SUPERVISORS IN CONNECTION WITH FORM "E," IN CASES WHERE THE IMPROVEMENT OF HIGHWAY HAS BEEN UNDERTAKEN UPON THE PETITION OF THE PROPERTY OWNERS AND THE RESOLUTION OF THE BOARD OF SUPERVISORS ONLY.

Resolved, That of the total estimated cost of said improvement amounting to $.........., thirty-five per cent. thereof, amounting to $..........., shall be paid by the county of...........
and said 35% ($............), together with the accumulated interest thereon, shall be inserted in the general tax levy for the year..................; and that fifteen per cent. of said total, amounting to $............ shall be assessed upon and paid by the owners of the lands benefitted by said improvement, to the extent and in the manner provided by the provisions of chapter 115, Laws of 1898, relating thereto.

I hereby certify that the above is a true copy of the resolution passed by the Board of Supervisors of..............county, at a meeting held on the ....day of................
19....

....

Clerk.

(Attach seal.)

"H."

FORM OF RESOLUTION TO BE ADOPTED BY THE BOARD OF SUPERVISORS PROVIDING FOR REQUISITION OF THE RIGHT OF WAY. THIS RESOLUTION TO BE PASSED (WHERE NECESSARY), IN CONNECTION WITH THE RESOLUTION ADOPTING PLANS, SPECIFICATIONS AND ESTIMATE SUBMITTED BY THE STATE ENGINEER AND SURVEYOR, IN FORM "E."

Resolved, That the chairman of this board appoint a committee of three, which committee is hereby authorized to secure the requisite right of way for the section of the..............road in the town of.................county of.................N. Y., which is to be improved in accordance with the provisions of chapter 115, Laws of 1898. That said committee is authorized to obtain said right of way, either by dedication or legal proceedings, as may be necessary, in order that said right of way shall conform to the boundaries of the section of said...........road as laid out in the maps and plans prepared for the improvement of said road under the direction of the State Engineer and Surveyor, wherever the boundaries of the proposed new section of said road deviate from the present boundaries and cross the present section of the existing highway.

The said committee are directed to procure such right of way at the earliest time practicable, and as soon as the same is secured, the committee shall report to the clerk of the Board of Supervisors, who shall notify the State Engineer and Surveyor in writing; this notice shall be considered proof that the Board of Supervisors have complied with paragraph 7, of chapter 115, of the Laws of 1898.

I hereby certify that the above is a true copy of the resolution passed by the Board of Supervisors of..............county, at a meeting held on the...............day of...............
19....

....
Clerk.

(Attach seal.)

REPORT

OF THE

DIVISION ENGINEER

OF THE

EASTERN DIVISION.

For the Year Ending September 30, 1899.

Eastern Division.

NEW YORK STATE CANALS.

OFFICE OF THE DIVISION ENGINEER.

ALBANY, N. Y., *October* 1st, 1899.

HON. EDWARD A. BOND, *State Engineer and Surveyor:*

Sir:—I have the honor to submit the annual report of the eastern division for the fiscal year ending September 30th, 1899.

This division comprises in navigable waters that portion of the Erie Canal lying between Albany and the east line of Oneida county a distance of

county a distance of	106.243	miles
Port Schuyler and Watervliet side cuts	.350	"
Albany basin	.770	"
Champlain canal including Waterford sidecut and Cohoes, and Saratoga dams	66.000	"
Pond above Troy dam	3.000	"
Glens Falls feeder and pond	12.000	"
Total	188.363	miles

The other feeders, none of which are navigable, are as follows:

Mohawk river at Rexford Flats	.39	miles
Mohawk river, south side, at Little Falls	.19	"
Mohawk river at Rocky Rift	3.92	"
Schoharie Creek at Fort Hunter	.63	"
Total	5.13	miles

The water supply for this division is obtained in the following manner: Between the east line of Oneida county and Little Falls water is supplied from reservoirs and streams on the middle division through the Rome level.

From Little Falls to Mindenville, water is obtained by a dam in the Mohawk river, furnishing water for the feeder entering the Erie canal just below lock No. 39 on the tow-path side.

From Mindenville to near Fort Hunter, the canal is fed by the Rocky Rift feeder which obtains its supply from a dam in the Mohawk river some four miles west of Mindenville and enters the level between locks numbers 33 and 34 on the tow-path side some 400 feet east of lock No. 34.

From near Fort Hunter to Rexford Flats the supply is from the Schoharie Creek discharging into the level between locks numbers 28 and 29 some 400 feet below lock No. 29 on the berme side.

From Rexford Flats to the foot of the "sixteens" in Colonie, the supply is drawn from the Mohawk river which is damned at the point first mentioned and discharges through this feeder about 80 feet below lock No. 21, through the tow-path side, into the level between locks Nos. 20 and 21.

At the foot of the "sixteens" or at lock No. 3 on the Erie canal, the supply is augmented by the waters of the Champlain canal, which forms its junction with the Erie canal at this point, and both waters serve to supply the Erie canal to its terminus in Albany.

The water supply of the Champlain canal is principally from the Hudson river through the Glens Falls feeder which empties into the summit level of the canal between locks numbers 15 and 16 supplying waters from Northumberland, some 10 miles to the south of its entrance, to Whithall some 30 miles to the north being supplemented at lock No. 18 by the waters of Wood Creek.

From Northumberland to the first lock north of Waterford, the water supply is from the Hudson river entering the canal at Northumberland stored by the Saratoga dam.

From the first lock north of Waterford to its junction with the Erie canal including the Waterford sidecut, the supply is from the Mohawk river entering the canal at Cohoes, where it is stored by the Cohoes dam, and at its junction with the Erie canal, at lock No. 3 in Colonie with the waters of the latter canal drawn from the Rexford Flats feeder.

The supply has been somewhat short during the latter part of the year on account of the unusual dry weather prevailing throughout the summer.

The intake of the Schoharie Creek Feeder which is an old lock of the original Erie canal is in a dilapidated condition but the Superintendent of Public Works intends to make the structure safe during the coming winter.

The same can be said of the culvert carrying the Rexford Flats Feeder under the Erie canal which will be repaired at the close of navigation.

A change in the bulkhead at the Rocky Rift Feeder by enlarging the gates and placing a fender protection in front of it is much to be desired as it would facilitate the feeding of the water supply from this source to a great degree.

The dam at this point should also be overhauled and repaired. Fortunately no breaches occurred on this division during the year the most dangerous points having been rebuilt last winter—I refer to the rebuilding of culverts Nos. 17, 39 and 45 on the Erie canal.

SPECIAL APPROPRIATIONS.

Dyke on Neversink river, town of Deerpark, Orange county, N. Y.—Chapter 291, Laws of 1897—appropriation $5,000.

This work was done by the forces of the Superintendent of Public Works. It consisted in building a dyke at Roses Point to stop the inroads of the Neversink river at this point during times of high water, and nearly a mile of dry wall along the bank of the river at all low places that were apt to be flooded.

The dyke at Roses Point was faced with a cobble wall about 600 feet long, laid in cement and the improvement has had the desired effect of confining the waters of the river to its bed. This work was finished within the engineer's estimate.

Removing obstructions and erection of a dam on Raquette river near Ramondville, St .Lawrence county, N. Y. Chapter 569, Laws of 1899. Appropriation $2,500—William Coats, contractor.

The upper dam in the village of Ramondville failed during the winter of 1898 thus destroying the pond formed above it. This pond always held the down-coming ice in check but the failure of the dam allowed the same to sweep down with considerable force causing much damage to the village. It was deemed advisable to rebuild the same. The new dam is 300 feet long and 10 feet high. It was built at the very reasonable sum of $2,268. It is a stone-filled crib anchored securely to the rock bottom of the river by iron bolts and is a very substantial structure. The contract was let in a lump sum, and within the engineer's estimate.

Building a wall at Washington's Headquarters at Newburgh, N. Y. Chapter 606, Laws of 1898. Appropriation $5,000—John Twoomey, contractor.

This work consists of building a retaining wall around the grounds in which the headquarters are located. Considerable rock excavation is involved in the contract and it is not completed at the time of this writing.

Changing the channel of the Basha Kill Stream at its junction with the Pine Kill, Sullivan county, N. Y. Chapter 621, Laws of 1898. Appropriation $5,000—Brummelkamp & Lane, contractors.

This work consisted in building a baffle dam in thePineKill and removing the bar which had formed at the junction of the Pine Kill and Basha Kill. The Pine Kill empties into the Basha Kill and is a creek of rapid fall, discharging directly from the high hills into the Neversink valley. It carries with it during times of flood or heavy thunder storms large quantities of gravel and talus which lodges in the Basha Kill forming a high bar. The Basha Kill which runs through the Neversink valley is a winding sluggish stream with little fall, and consequently its waters are damned by this bar, the set back extending some five miles up the valley. To overcome this difficulty a baffle dam with a large catch basin behind it was constructed in the Pine Kill and the bar in the Basha Kill excavated. The water level at the railroad bridge, about one thousand feet above the junction of the two streams, was lowered 45 inches but the ffect of this improvement will not be felt until the enormous quantities of eel grass with which the bed of the Basha Kill is choked, die off during the fall and winter. The dam was constructed of concrete formed of Portland cement mixed with the creek gravel and sand and will overcome the difficulty experienced at this point without a doubt. This contract was completed and for the sum of $3,471.93 which was $1,127.17 below the engineer's estimate.

Building a dam across the Saranac River at Saranac Lake, N. Y. Chapter 627, Laws of 1898. Appropriation $10,000—Gillette Hay & Gillette, contractors.

This is a stone dam to replace an old wooden one situated about half way between Saranac Lake village and Lower Saranac Lake across the Saranac river. It is a substantial structure built of the granite stone occurring in that vicinity. This dam will raise the water level of Lower Saranac Lake 18 inches when completed. The contract is still pending.

Repairs to Draw Bridge across Minisceongo Creek, Rockland county, N. Y. Chapter 631, Laws of 1898. Appropriation $6,000—Gillette, Hay & Gillette, contractors.

The work consists in replacing the pile protection for the bridge and center pier of the same and is still in course of construction.

Deepening and widening the canal between Shinnecock and Great South Bays. Chapter 207, Laws of 1898. Appropriation $10,000—E. W. Wicks, contractor.

The above named channel was widened and straightened between these two bays and has had the desired effect of doing away with the sluggish water existing around the village Quogue. Since the channel has been straightened and its depth increased to five feet throughout, the waters of Great South Bay once more flow unobstructed through to Shinnecock Bay and vice versa according to the direction of the wind there being no rise or fall of the tide at this point. It has benefited the oyster industry to a great degree, freight can be delivered at Quogue by sloops and pleasure craft can visit either bay without difficulty. This work is not quite completed, as a few sand bars remaining should be removed. The work however, will be finished well within the engineer's estimate. The engineering expenses of this work during the year appear under the heading of special work in the summary of tables.

EXTRAORDINARY REPAIRS.

Rebuilding part of Culvert No. 17 near Cresent.

This work consisted of building a new brick arch for that portion of the culvert that extended under the prism of the canal. The rebuilding undoubtedly saved the canal on this level from serious damage as it was in a dilapidated and dangerous condition The work was done by the forces of the Superintendent of Public Works.

Culvert No. 39, about one mile below Amsterdam.

This culvert was of late years a constant menace to the integrity of the canal at this point. A portion of the culvert was rebuilt with a brick arch and it now a substantial structure. The final estimate exceeded the contract price by $286.60 caused by additional work. Joseph H. Connors, contractor.

Culvert No. 45, about three miles above Amsterdam. This culvert was taken out and a line of 48 inch cast iron pipe with suitable headwalls constructed. This was also a very dangerous point, a bad break having occurred at this culvert in 1897. The work was done by the forces of the Superintendent of Public Works.

At the reguest of the Superintendent of Public Works, plans and estimates were prepared for the following pieces of work: Wilburs Basin waste wier, Champlain canal; Mechanicville waste weir, Champlain canal; waste weir No. 12, Champlain canal; rebuilding bridge abutment No. 45, Champlain canal; improving Glens Falls feeder, Sandy Hill, chap. 665, Laws of 1899; rebuilding culvert at Rexford flats, Erie canal; rebuilding trunk

Upper Mohawk aqueduct, 5 spans, Erie canal; rebuilding bridge abutment No. 39, Erie canal; rebuilding bridge abutment No. 40, Erie canal; tile drain at Frankfort, chap. 662, Laws of 1899.

REXFORD FLATS DAM.

The apron of this dam had been washed away until only about one-fifth of the original apron, a stone filled crib, decked over, remained. A fish-way through the south end of the dam was also in a dangerous condition. A portion of the dam near the north end was built on timber cribs and masonry, the crest had settled to such an extent that it was impossible and dangerous to make close examinations until that part of the work was drained. In June, 1895, plans were prepared for a steel apron with timber deck but as no bids were within the appropriation of $20,000, under chapter 560, Laws of 1895, all bids were cancelled. The fishway had become so dangerous that the Superintendent of Public Works was authorized to repair this part and pay for the same out of the above mentioned appropriation. The fishway was removed by permission of the State Fish, Game and Forest Commission and a continuation of the masonry dam was constructed in its place.

In the summer of 1896 new plans were prepared. The Canal Board set aside the sum of $9,424 from chapter 947, Laws of 1896, to be used with the remaining portion of the first appropriation for this purpose, but again no bids were received within the limit of available funds. All bids were once more cancelled.

In 1897 new plans were prepared on different lines. A crib apron being designed. The Canal Board set aside an additional sum of $7,644 (and $3,022 for engineering) from chapter 566, Laws of 1897, to be used with the former appropriations for the work. The contract was awarded in September, 1897, and work was started immediately but discontinued during the winter. Work again started in July, 1898. On draining the work it was discovered that the portion of the dam which was founded on a timber crib was so badly damaged that it would have to be rebuilt, although not part of the original contract. This excess of cost was met by the Superintendent by payment from Ordinary Repairs fund.

The Engineer's estimate amounted to....	$30,218 00
The estimate at contract prices..........	25,981 50
The final estimate was for...............	34,283 90

There was appropriated:

By chapter 560, Laws of 1895............	$20,000 00
From chapter 947, Laws of 1896, by Canal Board	9,424 00
From chapter 566, Laws of 1897, by Canal Board	7,644 00
From chapter 566, Laws of 1897, by Canal Board, for engineering..................	3,022 00
From chapter 550, Laws of 1898, ordinary repairs	3,234 75
	$43,324 75
Inspection, engineering, advertising and repairing fishway (the latter cost $5,620.27)	$9,040 52
	$34,284 23
Final estimate	$34,283 90

Work was completed October 24th, 1898. Whalen & Higgins, contractors.

Repairs to Moyer creek, banks, bed and drops. Chapter 128, Laws of 1898.

The above act appropriated $6,000 for this purpose. Moyer creek has been the source of a great many damage cases since the State changed the old channel to the present location. The appropriation was made to stop leakage, to raise the banks, to make them safe during time of high water and to prevent overflows.

This work has been done by the force of the superintendent of public works on plans submitted by this department and under the supervision of one of its engineers.

Bridge over the Erie canal in the town of Minden, chapter 596, Laws of 1899.

Plans for this bridge are in the course of preparation.

Lift bridge over the Erie canal at Canajoharie, chapter 562, Laws of 1897, and chapter 477, Laws of 1899.

Plans have been prepared but contract has not yet been awarded.

Bridge over the Champlain canal at Ontario street, Cohoes, chapter 613, laws of 1899.

Plans are in course of preparation.

Bridge over the Glens Falls feeder at Main street, Sandy Hill, chapter 623, laws of 1898.

This contract was awarded to Messrs. Monty, Higley & Barber on April 21st, 1899, for the sum of $5,443.20. Work will commence at the close of navigation, this year.

New blue line maps, Erie, Oswego and Champlain canals, chapter 569, laws of 1899.

The Erie canal has been mapped from Albany to Rome and the work is now going on. These maps proved of great value in the trial of damage cases at a recent session of the court of claims, additional appropriations should be made to continue this good work, while the data is still fresh, and many of the engineers having charge of the surveys are still in the employ of the state.

Improvement of Erie and Champlain canals, chapter 79, laws of 1895, chapter 794, laws of 1896, chapter 43, laws of 1897, chapter 569, laws of 1897.

Final accounts and last estimates were rendered on all contracts under these laws, finished and pending on this division. All figures are shown in tables appended, it is therefore unnecessary to repeat them here.

(Statement on blue print submitted by Mr. Bond to the Legislature, showing status of all contracts and estimates to finish.)

IMPROVEMENT OF PUBLIC HIGHWAYS.

Chapter 115, Laws of 1898, and chapter 569, Laws of 1899.

The subject of road improvement under the Higbie-Armstrong act has taken up a good deal of time and attention on this division.

Too much stress cannot be laid upon the part that falls to the engineer in the building of an improved highway from the very beginning of construction. The surveys, the calculations of quantities, the establishing of proper grades, and the preparation of plans are of course the preliminary steps which are necessary and occur in the every day routine of the engineer's work, but it is when construction commences that his entire time is taken up in supervision. This supervision of every part of the work must be so rigid that no errors should occur or at least these should be reduced to a minimum, as nothing is perfect.

Constant and intelligent supervision only produces the best results and it is not every man on the engineer's force that has the necessary attributes to make him a good road builder.

Watchfulness, good, hard, common sense, a quick eye, and a constant use of sound judgment aside from his technical abilities, are the requirements of such a man. To this should be added chief of all, *experience.* It is here that a difficulty arises as the engineering force of the State changes frequently and an engineer that severs his connection with the State work at the end of the alloted term of his chief, becomes useless to the State as a road builder, although he may have given thorough attention to that class of work while holding office, and continuity of service with an engineer possessing all other requirements of the civil service is a thing much to be desired, especially as he has practically acquired such knowledge at the expense of the State.

Such a man as I describe should be on the ground constantly, arriving there when the workmen commence their daily task. His first care should be the preparation of the subgrade, to watch that the same is rolled to a uniform hard surface, that no soft spots have been overlooked and that all of these are treated in the proper manner. That the grades in all ditches are true and evenly excavated. But it is when the road metal is being delivered and spread that his attention must be constant. He must watch the size of the stone delivered as to its uniformity, that they are properly spread and properly rolled. It is he that must control the judicious use of water while rolling is being done, and watch the proper addition of screenings and binder. He must keep his eye on the roller to see that the machine rolls from the sides to the middle of the road, that the crown is kept in perfect section and that the grades are being rolled evenly.

He should be familiar with the workings of a crushing plant, where such an one is used, a general knowledge of mineralogy and be able to tell quickly if unsuitable rock is being crushed and stop its delivery. In fact he must be everywhere while work is going on and such supervision alone will insure the success of our road building.

During the present year the highway known as the Troy and Schenectady Turnpike, for a distance of two miles was completed. This work was commenced under the preceding administration but the major portion of it was built under the present regime. This roadway is 22 feet wide between ditches with a macadam surface in the center 16 feet wide. The roadbed was first graded and then thoroughly compacted by using a ten-ton steam roller exerting a pressure of 500 pounds per inch run. The macadam surface consisted of two courses, the lower one four inches thick, the upper two inches thick after rolling. The lower course was of limestone from the Bethlehem quarries of the Callanan Road Improvement Co. The top course consisted of trap rock from the Palisades. The original specifications for the top course called for trap rock varying in size from ½ to 1¼ inches to be compacted by screenings of the same class of stone. It was found almost at once that these trap rock screenings would not amalgamate with the larger size of stone no matter how much they were rolled and a change was made at once by ordering lime stone screenings in their place.

In the light of recent experience and practice a change was also made in the size of the stone for the top course sizes varying from 1 1-4 to 2 inch, being substituted. These changes gave excellent results and were embodied in our subsequent specifications. It may be of interest to road builders to give the exact amount of stone used in the construction of this road.

The road is 2 miles long and 16 feet wide—

Bottom course 4 inches compacted, 2,860 cubic yards of stone used and 693 cubic yards of screenings. Top course of trap, 2 inches compacted. 1,237 cubic yards of stone used, and 140 cubic yards of screenings.

It appears therefore from the data obtained from this and other roads that in this section of the country, if taken as a 6-inch road, the cubical contents multiplied by 1.35 will give very nearly the quantity of stone in the bin necessary for the construction of a road of the above dimensions with a little over 20% added for screenings. As most authorities give this constant as 1.2 and as I can find no data as to the proportion of screenings to be used, it occurs to me that this information is useful and acceptable.

In connection with this road it must be mentioned with regret that no steps whatever have been taken to provide for its maintenance.

The ditches have not been cleaned since its completion nor has any attention whatever been paid toward keeping the macadam surface free from dirt or occasional stones, although repeatedly visited by unusually heavy thunderstorms, accompanied by torrents of rain, the macadam surface is as good as new to-day, but the ditches have filled up in places and the wings have been washed somewhat. I cannot be too emphatic in saying that proper maintenance is absolutely necessary to a macadam road and some addition should be made to the existing law or additional legislation enacted providing for maintenance of roads in some manner. It is plain that the average board of supervisors do not give a road the care it should have and the best efforts of this Department will amount to nothing if a road is allowed to deteriorate immediately after completion.

This road was completed at a cost of $7,280 per mile or a lump sum of $14,590 and included grading, ditching, culverts and macadam surface. The Callanan Road Improvement Company were the contractors.

The Lebanon and Pittsfield road was also completed during the present year. This road is of an entirely different character from any of the other roads planned or finished. The old road was a difficult ascent for teams, many grades of 17, 18 and one grade of 20 per cent. occurring on it, until the top of the mountain was reached. On the new road no grade is steeper than 5 per cent., and the distance is increased but slightly. A junction is made at the State line with an improved road being constructed by the Massachusetts Highway Commission, graded on the same lines and containing no grade steeper than 5 per cent., thus reaching the top of the mountain where it connects with our new road.

Economy demanded that our road should be built with a gravel covering instead of macadam, a gravel of very good quality having been found on adjacent land. This road, including one 48-inch iron pipe culvert, one 40-foot span steel bridge, the necessary vitrified pipe cross-drains, including the masonry, head walls and abutments, together with 14,000 cubic yards of side hill excavation was completed at the contract price of $7,800, and is an excellent object lesson in general road improvement. Edward Matthews was the contractor.

Two more roads are under contract, namely, the Troy and Brunswick Road and the Troy and Greenbush Road but will not be completed this year.

A plan was also prepared for the construction of a road known as the Delaware Turnpike in Albany county. This plan was accepted by the supervisors and condemnation proceedings of the land to be taken for the improvement are now in progress and will throw the construction of this road into next year.

Another plan was prepared and accepted by the supervisors of Saratoga county for the improvement of one and one-eighth miles of road between the villages of Waterford and Mechanicville. Owing to the defective wording of the resolution of acceptance by the supervisors the construction of this road will also be postponed until next year.

Nearly 45 miles of roads have been surveyed and mapped in Orange county and the same party is now engaged in Westchester county having surveyed and mapped nearly 40 miles of roads.

I would most earnestly repeat the recommendation contained in the State Engineers report for 1898 in which he calls attention to a desired modification of the Good Roads Law which reads as follows: " The present law does not provide any means of changing the plans or specifications after a contract has been awarded. If any considerable amount of work is to be done numerous occasions will arise where such changes will be absolutely necessary for the best interests of all concerned.

SPECIAL SURVEYS.

The reports on surveys and maps for the State Board of Claims; the copying and preserving old maps, surveys, notes, etc.; the making of maps of the shore line of Westchester county; examination of maps and monuments; boundary line between Lewis and Herkimer counties, and the topographic survey will be handed you, to be included in the report proper of the State Engineer and Surveyor, but the detailed tables of the men employed and the compensation will be found by referring to the tabes annexed to this report.

ORGANIZATION AND WORK ON THE EASTERN DIVISION.

This division was under the charge of Mr. Dewitt C. Smith as division engineer from September 30, 1898, to April 1, 1899, and under my charge since. I have been ably assisted in the work by Mr. H. A. VanAlstyne, first assistant engineer. To him and to the subordinate members of the corps I desire to tender my thanks for their steady application and the promptness which each has shown in the discharge of their various duties.

Their work has been the making of surveys, plans and estimates for the work heretofore detailed, the superintendence of all contract work and rendering such professional work as the occasion demanded or as the Superintendent of Public Works requested in connection with ordinary repairs on the canals.

'A statement of the engineering expenses of the division is hereto annexed, showing in detail the names of persons employed, time of service and compensation of each.

Very respectfully,

T. C. LEUTZE,

Division Engineer.

STATEMENT SHOWING NAMES, RANK, NUMBER OF DAYS AND COMPENSATION OF ENGINEERS EMPLOYED ON THE EASTERN DIVISION OF THE NEW YORK STATE CANALS, TOGETHER WITH INCIDENTAL EXPENSES DURING THE FISCAL YEAR ENDING SEPTEMBER 30, 1899.

Ordinary Repairs—Erie Canal.

(Chapter 550 Laws of 1898, and Chapter 569 Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Dewitt C. Smith	Division engineer	....	$3,000 per yr.	$1,000 02	$59 46	$1,059 48
Trevor C. Leutze	Division engineer	....	3,000 per yr.	1,000 02	45 30	1,045 32
Trevor C. Leutze	First asst. engineer	58	6 00	348 00	79 27	427 27
H. A. Van Alstyne	First asst. engineer	14	6 00	84 00	26	84 26
Marcus H. Ranney	Assistant engineer	9	5 00	45 00	6 79	51 79
W. L Lawton	Assistant engineer	27	5 00	135 00	1 86	136 86
Douglas Cornell	Assistant engineer	34	5 00	170 00	12 02	182 02
C. W. Trumbull	Assistant engineer	34	5 00	170 00	....	170 00
C. C. Huestis	Assistant engineer	49	5 00	245 00	....	245 00
A. M. Evans	Assistant engineer	24	5 00	120 00	16 48	136 48
John J. Allen	Assistant engineer	75	5 00	375 00	....	375 00
Dorlon Clark	Assistant engineer	19	5 00	95 00	....	95 00
F. E. Spinner	Leveler	9	4 50	40 50	....	40 50
Fred S. Strong	Leveler	30	4 50	135 00	....	135 00
Dorlon Clark	Leveler	137	4 50	616 50	....	616 50
Ralph Russell	Leveler	93	4 50	418 50	28 29	446 79
Seth M. Van Loan	Leveler	22	4 50	99 00	....	99 00
T. A. Hendrickson	Leveler	....	....	....	4 43	4 43
Geo. L. Schillner	Draftsman	211	4 50	949 50	....	949 50
L. B. Jones	Leveler	58	4 50	261 00	....	261 00
C. M. Pepson	Rodman	86	3 50	301 00	51 50	352 50
O. J. Dempster	Rodman	53	3 50	185 50	7 18	192 68
Frank Roberts	Rodman	81	3 50	283 50	11 88	295 38
H. J Richardson	Rodman	165	3 50	577 50	30 08	607 58
Frank Lutz	Chainman	79	3 00	237 00	16 24	253 24
Wm. Van Epps	Chainman	28	3 00	84 00	1 16	85 16
Henry F. Smith	Chainman	27	3 50	94 50	12 88	107 38
Parkes D. Wendell	Chainman	6	3 50	21 00	....	21 00
George McDonald	Chainman	3	2 50	7 50	....	7 50
F. H. Lomax	Chainman	17	2 50	42 50	1 60	44 10
L L. Melius	Chainman	....	....	....	5 06	5 06
W. J. Valleau	Clerk	132	5 00	660 00	....	660 00
George Lilly	Labor	52	3 00	156 00	8 40	164 40
John J. Carney	Labor	21	3 00	63 00	10 60	73 60
Ernest J. Atkins	Labor	121	3 00	363 00	....	363 00
H. B. Townsend	Labor	26	2 25	58 50	....	58 50
A. P. Sullivan	Labor	....	$10 per mo.	70 00	....	70 00
L. A. Joslin	....	....	....	....	12 50	12 50
						$9,934 78

Incidental expenses.

Office Rent	$24 00	
Stationery	378 52	
Postage	88 43	
Telephone and telegraph	137 14	
Livery	67 50	
Fuel and light	2 70	
Miscellaneous	220 99	
		869 28
		$10,801 06

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Ordinary Repairs—Champlain Canal.

(Chapter 550, Laws of 1898, and Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation	Salary.	Travel.	Total.
Dewitt C. Smith	Division engineer	....	$3,000 per yr.	$499 98	$12 46	$512 44
Trevor C Leutze	Division engineer	....	3,000 per yr.	499 98	18 56	518 54
John R Kaley	First asst. engineer	103	6 00	618 00	34 14	652 14
Trevor C. Leutze	First asst. engineer	17	6 00	102 00	....	102 00
Foster B. Morss	Assistant engineer	44	5 00	220 00	7 20	227 20
John J. Allen	Assistant engineer	117	5 00	585 00	56 86	641 86
L. B. Jones	Leveler	53	4 50	238 50	25 10	263 60
T. A. Hendrickson	Leveler	19	4 50	85 50	1 10	86 60
F. N. Sanders	Leveler	41	4 50	184 50	....	184 50
John A O'Connor	Draftsman	49	3 50	171 50	7 20	178 70
W. J. Gilmour	Rodman	106	3 50	371 00	19 17	390 17
H. J. Richardson	Rodman	53	3 50	185 50	2 61	188 11
Frank Roberts	Rodman	31	3 50	108 50	3 17	111 67
H. W. DeGraff	Rodman	15	3 50	52 50	....	52 50
C. M. Pepson	Rodman	21	3 50	73 50	....	73 50
R. M. Booth	Chainman	31	3 50	108 50	....	108 50
F. H. Lomax	Chainman	31	2 50	80 00	80	80 80
Wm. Van Epps	Chainman	....	....	....	4 38	4 38
W. J. Valleau	Clerk	25	5 00	125 00	....	125 00
W. W. Borst	Labor	26	3 50	91 00	....	91 00
George Lilly	Labor	27	3 00	81 00	....	81 00
Ernest J. Atkins	Labor	26	3 00	78 00	....	78 00
A. P. Sullivan	Labor	....	$10 per mo.	50 00	....	50 00
						$4,802 21

Incidental expenses.

Office rent	$18 00	
Stationery	182 66	
Livery	150 50	
Telephone and telegraph	104 25	
Postage	6 86	
Miscellaneous	108 11	
		570 38
		$5,372 59

Extraordinary Repairs—Erie Canal.

(Chapter 506, Laws of 1898, and chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. A. Van Alstyne	First asst. engineer	29	$6 00	$174 00	$1 90	$175 90
H. A. Van Alstyne	Assistant engineer	13	5 00	65 00	34	65 34
W. L. Lawton	Assistant engineer	2	5 00	10 00	2 36	12 36
C. W. Trumbull	Assistant engineer	14	5 00	70 00	....	70 00
C. H. Flanigan	Assistant engineer	24	5 00	120 00	....	120 00
Dorlon Clark	Assistant engineer	46	5 00	230 00	33 30	263 30
J. J. Allen	Assistant engineer	27	5 00	135 00	....	135 00
Dorlon Clark	Leveler	7	4 50	31 50	4 90	36 40
L. B. Jones	Leveler	58	4 50	261 00	28 03	289 03
Seth M. Van Loan	Leveler	18	4 50	81 00	....	81 00
Ralph Russell	Leveler	97	4 50	436 50	53 51	490 01
John A. O'Connor	Draftsman	4	4 50	18 00	88	18 88
O. J. Dempster	Rodman	26	3 50	91 00	4 04	95 04

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Erie Canal—(Continued).

NAME.	Rank	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. W. DeGraff	Rodman	24	$3 50	$84 00	$8 18	$92 18
R. S Greenman	Rodman	52	3 50	182 00	....	182 00
W J. Gilmour	Rodman	53	3 50	185 50	13 95	199 45
H. J Richardson	Rodman	25	3 50	87 50	1 60	89 10
C. M. Pepson	Rodman	17	3 50	59 50	....	59 50
Frank Roberts	Rodman	30	3 50	105 00	8 19	113 19
Wm. Van Epps	Chainman	28	3 00	84 00	1 41	85 41
F. H Lomax	Chainman	5	2 50	12 50	....	12 50
H. B. Townsend	Labor	....	....	58 50	....	58 50
						$2,744 09

Incidental expenses.

Office rent	$25 00	
Telephone and Telegraph	95	
Livery	119 00	
Miscellaneous	42 62	
		187 57
		$2,931 66

Extraordinary Repairs—Champlain Canal.

(Chapter 506, Laws of 1898, and Chapter 208, Laws of 1899).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
John R. Kaley	First asst. engineer	26	$6 00	$156 00	$1 00	$160 00
Foster B. Morss	Assistant engineer	26	5 00	130 00	....	130 00
Dorlon Clark	Assistant engineer	18	5 00	90 00	11 91	101 94
F. J. Lempe	Leveler	26	4 50	117 00	5 50	122 50
L. B Jones	Leveler	26	4 50	117 00	....	117 00
L. B. Jones	Leveler	12	4 50	54 00	2 10	56 10
Geo L. Schillner	Draftsman	28	4 50	126 00	....	126 00
Jno. A. O'Connor	Draftsman	6	4 50	27 00	....	27 00
H. W. DeGraff	Rodman	9	3 50	31 50	8 19	39 69
C. M. Pepson	Rodman	6	3 50	21 00	6 69	27 69
F. A. Lomax	Chainman	10	2 50	25 00	9 07	31 07
						$941 99

Incidental expenses.

Livery	$25 00	
Miscellaneous	70	
		25 70
		$967 69

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Building Stone Arch Culvert—Erie Canal at Little Falls, N. Y.

(Chapter 91, Laws of 1899.

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. A. Van Alstyne	First asst. engineer	5	$6 00	$30 00	$4 64	$34 64
Dorlon Clark	Assistant engineer	5	5 00	25 00	3 22	28 22
A M. Evans	Assistant engineer	37	5 00	185 00	2 96	187 96
L. B. Jones	Leveler	5	4 50	22 50	2 72	25 22
F. Roberts	Rodman	5	3 50	17 50	3 22	20 72
H. W. Degraff	Rodman	5	3 50	17 50	3 22	20 72
Geo. Penfield	Rodman	11	3 50	38 50	....	38 50
H. J. Richardson	Rodman	2	3 50	7 00	....	7 00
F. H. Lomax	Chainman	5	2 50	12 50	3 22	15 72
						$378 70

Incidental expenses.

Postage	$1 00	
Telephone and telegraph	2 10	
Miscellaneous	19 78	
		22 88
		$401 58

Improvement Erie Canal.

Chapter 79, Laws of 1895, Chapter 794, Laws of 1896, Chapter 43, Laws of 1897, Chapter 569, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
George McDonald	Chainman	4	$2 50	$10 00	....	$10 00
George Lilly	Labor	....	....	12 00	....	12 00
						$22 00

Incidental expenses.

Stationery	$135 05	
Livery	20 00	
Miscellaneous	223 67	
		378 72
		$400 72

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Improvement Champlain Canal.

(Chapter 79, Laws of 1895, Chapter 794, Laws of 1896, Chapter 43, Laws of 1897, and Chapter 569, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
Wm J. Gilmour	Rodman	26	$3 50	$91 00	....	$91 00
Henry F. Smith	Rodman	4	3 50	14 00	....	14 00
R. M. Booth	Rodman	4	3 50	14 00	....	14 00
Frank Lutz	Chainman	4	3 00	12 00	....	12 00
Parkes D Wendell	Chainman	....	....	14 00	....	14 00
O. J. Dempster	Rodman	....	....	14 00	$3.84	17 84
						$162 84
Incidental expenses.						
Stationery					$135 05	
Livery					20 00	
Miscellaneous					223 66	
						378 71
						$541 55

Rexford Flats Dam—Erie Canal.

(Chapter 560, Laws of 1895, Chapter 947, Laws of 1896, and Chapter 566, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. C. Huestis	Assistant engineer	26	$5 00	$130 00	$4 90	$134 90
R. S. Greenman	Rodman	23	3 50	80 50	....	80 50
James T. Brady	Chainman	15	2 50	37 50	3 97	41 47
						$256 87

Fort Plain. Lift Bridge—Erie Canal.

(Chapter 576, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation	Salary.	Travel.	Total.
C. W. Trumbull	Assistant engineer	23	$5 00	$115 00	$5 42	$120 42
Douglas Cornell	Assistant engineer	12	5 00	60 00	....	60 00
C. C. Huestis	Assistant engineer	18	5 00	90 00	....	90 00
F. J. Lempe	Leveler	....	....	102 50	....	102 50
Seth Van Loan	Leveler	23	4 50	103 50	....	103 50
Frederick S. Strong	Leveler	13	4 50	58 50	....	58 50
Frank Roberts	Rodman	10	3 50	35 00	....	35 00
H. W. Degraff	Rodman	12	3 50	42 00	....	42 00
James T. Brady	Chainman	9	2 50	22 50	....	22 50
Parkes D. Wendell	Chainman	21	2 50	52 50	....	52 50
W. W. Borst	Labor	....	....	91 00	....	91 00
						$777 92

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

◆

Repairs to Moyer Creek—Banks, Bed and Drops.

(Chapter 128, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Dorlon Clark	Leveler	24	$4 50	$108 00	....	$108 00
L. B. Jones	Leveler	24	4 50	108 00	....	108 00
Frank Roberts	Rodman	12	3 50	42 00	....	42 00
						$258 00

Bridge, German Street, Erie Canal, Little Falls, N. Y.

(Chapter 680, Laws of 1895.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Lentze	First asst engineer	12	$6 00	$72 00	....	$72 00
W. L. Lawton	Assistant engineer	13	5 00	65 00	....	65 00
F. N. Sanders	Leveler	24	4 50	108 00	....	108 00
						$245 00

Bridge over Erie Canal—Town of Minden.

(Chapter 596, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Dorlon Clark	Assistant engineer	5	$5 00	$25 00	$4 06	$29 06
L. B. Jones	Leveler	5	4 50	22 50	3 56	26 06
H. W. Degraff	Rodman	5	3 50	17 50	4 06	21 56
F. H. Lomax	Chainman	5	2 50	12 50	4 21	16 71
						$93 39

Lift Bridge over Erie Canal at Canajoharie, N. Y.

(Chapter 477, Laws 1899.)

Incidental expenses, miscellaneous	$40 61

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Bridge Over Champlain Canal—Ontario Street, Cohoes, N. Y.

(Chapter 613, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Dorlon Clark	Assistant engineer	5	$5 00	$25 00	$2 00	$27 00
L. B. Jones	Leveler	5	4 50	22 50	2 00	24 50
H. W. Degraff	Rodman	5	3 50	17 50	2 00	19 50
F. H. Lomax	Chainman	5	2 50	12 50	2 15	14 65
						$85 65

Bridge Main Street—Glens Falls Feeder, Sandy Hill, N. Y.

(Chapter 623, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Foster B. Morss	Assistant engineer	18	$5 00	$65 00	......	$65 00
George B. Hilton	Draftsman	....	....	52 50	......	52 50
						$117 50
Incidental expenses.						
Miscellaneous						9 44
						$126 94

New Blue Line Maps of Erie, Oswego and Champlain Canals.

(Chapter 569, Laws of 1899).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Geo. L. Schillner	Draftsman	41	$4 50	$184 50	....	$184 50

Dyke on Neversink River—Town of Deer Park, Orange County N. Y.

(Chapter 291, Laws of 1897).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutze	First ass't engineer	12	$6 00	$72 00	....	$72 00

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Removing Obstructions and Erection of a Dam on Raquette River near Raymondville, St. Lawrence County, N. Y.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Lentze	Division engineer	....	....	....	$1 71	$1 71
L. L. Melius	Chainman	53	$2 50	$132 50	27 04	159 54
						$161 25
Incidental expenses.						
Livery					$4 00	
Miscellaneous					6 75	
						10 75
						$172 00

Building a Wall at Washington's Headquarters at Newburgh, N. Y.

(Chapter 606, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. J. Gilmore	Rodman	41	$3 50	$143 50	$23 54	$167 04
Incidental expenses.						
Postage					$0 48	
Telephone and telegraph					1 10	
Miscellaneous					9 17	
						10 75
						$177 79

Changing Channel Basha's Kill Stream at junction with Pine Kill, Sullivan County, N. Y.

(Chapter 621, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
F. N. Sanders	Leveler	51	$4 50	$229 50	$12 62	$242 12
L. L. Melius	Chainman	25	2 50	62 50	8 31	70 81
						$312 93
Incidental expenses.						
Telephone and telegraph					$1 43	
Miscellaneous					37 04	
						38 47
						$331 40

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Building Dam Across Saranac River at Saranac Lake, N. Y.

(Chapter 627, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Ralph Russell	Leveler	53	$4 50	$238 50	$32 73	$.71 23
R. S. Greenman	Rodman	65	3 50	227 50	11 23	238 73
						$509 96
Incidental expenses.						
Postage					$1 00	
Telephone and telegraph					1 45	
Miscellaneous					56 49	
						58 94
						$568 90

Repairs to Draw Bridge Minisceongo Creek, Rockland County, N. Y.

(Chapter 631, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. J. Gilmour	Rodman	44	$3 50	$154 00	$30 90	$184 90
Harry A. Knapp	Chainman	61	2 50	152 50	11 16	163 66
Frank H. Lomax	Chainman				8 94	8 94
						$357 50
Incidental expenses.						
Telephone and telegraph					$0 90	
Postage					89	
Miscellaneous					10 42	
						12 21
						$369 71

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Deepening and Widening Canal Between Shinnecock and Great South Bay, New York State.

(Chapter 207, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutze	First asst. engineer	7	$6 00	$42 00	$90 36	$132 36
Douglas Cornell	Assistant engineer	7	5 00	35 00	38 70	73 70
Frederick S. Strong	Leveler	55	4 50	247 50	55 56	303 06
Henry F. Smith	Chainman	52	3 50	182 00	40 53	222 53
John J. Carney	Laborer	7	3 00	21 00	32 98	53 98
						$785 63

Incidental expenses.

Livery	$4 00	
Postage	25	
Labor	6 00	
Telephone and telegraph	9 82	
Miscellaneous	7 83	
		27 40
		$813 03

State Board of Claims State of New York.

(Chapter 606, Laws of 1898, and Chapter 569, Laws of 1899).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutze	First asst. engineer	50	$6 00	$300 00	$733 75	$1,033 75
H. A. Van Alstyne	First asst. engineer	18	6 00	108 00	13 09	121 09
Douglas Cornell	Assistant engineer	17	5 00	85 00	37 35	122 35
Dorlon Clark	Assistant engineer	2	5 00	10 00	28 06	38 06
Frederick S Strong	Leveler	119	4 50	535 50	289 68	825 18
Ralph Russell	Leveler	17	4 50	76 50	64 57	141 07
Geo. L Schillner	Draftsman	4	4 50	18 00	....	18 00
J. A. O'Connor	Draftsman	26	4 50	117 00	7 29	124 29
H. J. Richardson	Rodman	34	3 50	119 00	59 65	178 65
Jas. K. Browne	Rodman	105	3 50	367 50	211 47	578 97
Geo H. Penfield	Rodman	17	3 50	59 50	....	59 50
H. W. Degraff	Rodman	22	3 50	77 00	19 86	96 86
C M. Pepson	Rodman	68	3 50	238 00	7 05	245 05
Frank H. Lomax	Chainman	10	2 50	25 00	5 27	30 27
H. A. Knapp	Chainman	6	2 50	15 00	13 65	28 65
George McDonald	Chainman	105	2 50	262 50	218 92	481 42
Fred. H. Owens	Chainman	105	2 50	262 50	226 48	488 98
Parkes Wendell	Chainman	108	2 50	270 00	210 40	480 40
L. L. Melius.	Chainman	26	2 50	65 00	....	65 00
E. A. Bonney	Laborer	88	2 00	176 00	166 82	342 82
Wm Gregory	Laborer	48	2 00	96 00	87 42	183 42
John J. Carney	Laborer	10	3 00	30 00	22 04	52 04
Arthur Adams	Laborer	7	4 50	31 50	17 91	49 41
						$5,784 73

Incidental expenses.

Livery	$433 00	
Telegraph and telephone	56 94	
Postage	2 00	
Miscellaneous	432 17	
		924 11
		$6,708 84

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Copying and Preserving Old Maps, Survey Notes, Etc.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
John J. Allen	Assistant engineer.	59	$5 00	$395 00	....	$395 00
Ambrose Kelly	Chainman	41	3 00	123 00	....	123 00
						$518 00
Incidental expenses.						
Miscellaneous						56 50
						$574 50

Old Records, Maps and Surveys.

(Chapter 790, Laws of 1897.)

NAME.	Rank	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. H. Flanigan	Assistant engineer.	26	$5 00	$130 00	....	$130 00
C. D. Burrus	Draftsman	49	4 50	220 50	....	220 50
C. A. Poole	Draftsman	56	4 00	224 00	....	224 00
Mortimer S. Smith	Rodman	26	3 50	117 00	....	117 00
R. L. Adams	Laborer	....	....	173 00	....	173 00
						$864 50
Incidental expenses.						
Stationery						15 20
						$879 70

Maps Shore Lines of Westchester County, N.Y.

(Chapter 950, Laws of 1896, and Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
C. H. Flanigan	Assistant engineer	29	$5 00	$145 00	....	$145 00
C. A. Poole	Draftsman	75	4 00	300 00	....	300 00
C. D. Burrus	Draftsman	108	4 50	486 00	....	486 00
Mortimer S. Smith	Rodman	105	4 50	472 50	....	472 50
						$1,403 50
Incidental expenses.						
Miscellaneous						12 16
						$1,415 66

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Examination Monuments, Maps, Etc., State of New York.

(Chapter 606, Laws of 1898, and Chapter 569, Laws of 1899)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C H. Flanigan	Assistant engineer	52	$5 00	$260 00	....	$260 00
John J. Allen	Assistant engineer	26	5 00	130 00	....	130 00
H. A. Van Alstyne	Assistant engineer	27	6 00	162 00	....	162 00
Geo. L. Schillner	Draftsman	27	4 50	121 50	....	121 50
M. Peckham Jr	Draftsman	88	5 00	440 00	$537 99	977 99
H. W. Degraff	Rodman	6	3 50	21 00	....	21 00
L. K. Devendorph	Rodman	19	3 50	66 50	....	66 50
Ambrose Kelly	Chainman	26	3 00	78 00	....	78 00
F. H. Lomax	Chainman	6	2 50	15 00	....	15 00
R L Adams	Laborer	...	....	375 00	....	375 00
W. J. Brown	Laborer	7	2 25	15 75	....	15 75
B. G. Priest	Laborer	88	2 00	176 00	....	176 00
John O'Hara	Laborer	36	2 00	72 00	....	72 00
Frank Northrop	Laborer	20	2 00	40 00	....	40 00
						$2,510 74
Incidental expenses.						
Livery					$179 30	
Telephone and telegraph					96	
Miscellaneous					497 59	
						677 85
						$3,188 59

Boundary Line Lewis and Herkimer Counties.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
Guy Moulton	First asst. engineer	12	$6 00	$72 00	....	$72 00
C. H. Flanigan	Assistant engineer	100	5 00	500 00	$461 61	961 61
H. A. Van Alstyne	Assistant engineer	....	....	....	10 98	10 98
H. P. Willis	Leveler	84	4 50	378 00	....	378 00
Geo. Penfield	Rodman	10	3 50	35 00	....	35 00
H. W. Degraff	Rodman	19	3 50	66 50	11 32	77 82
O. J. Dempster	Rodman	28	3 50	98 00	....	98 00
James T. Brady	Chainman	92	2 50	230 00	....	230 00
Ambrose Kelly	Chainman	11	3 00	33 00	....	33 00
H. S. Ball	Chainman	12	3 00	36 00	....	36 00
Frank Oatman	Laborer	82	2 00	164 00	....	164 00
Richard Earl	Laborer	81	2 00	162 00	....	162 00
Frank Kellogg	Laborer	16	2 00	32 00	....	32 00
Michael McGraw	Laborer	75	2 00	150 00	....	150 00
Kent F. Dodge	Laborer	57	2 00	114 00	....	114 00
Avery Emerson	Laborer	58	2 00	116 00	....	116 00
Frank Brant	Laborer	59	2 00	118 00	....	118 00
W. H. Leary	Laborer	58	2 00	116 00	....	116 00
F. B. Lange	Laborer	30	2 00	60 00	....	60 00

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Boundary Line Lewis and Herkimer Counties — (Continued).

NAME.	Rank.	Number of days	Rate of compensation.	Salary.	Travel	Total.
Adam Casler	Laborer	30	$2 00	$60 00	....	$60 00
Ward Gallup	Laborer	18	2 00	36 00	....	36 00
Robert Brickley	Laborer	18	2 00	36 00	....	36 00
E. A. Bond	State Engineer	...	....	....	$16 05	16 05
Wm. Pierson Judson	D'puty State Engin'r.	....	....	....	125 47	125 47
						$3,237 93

Incidental Expenses.

Livery	$423 71	
Postage	3 00	
Telephone and telegraph	13 87	
Miscellaneous	1,565 91	
		2,006 52
		$5,244 45

Topographic Survey—State of New York.

(Chapter 219, Laws of 1898, and Chapter 96, Laws of 1899.)

Name.	Total.
H. T. Dickinson	$9 04
Robert D. Cummin	562 59
Wellington Kenwell	434 04
H. W. Powers	130 98
A. M. Walker	2,277 33
D. Norton	59 00
W. T. Griswold	718 23
H. A. Paull	255 25
George McDonald	197 50
E. B Clark	791 60
W. W. Gilbert	202 03
W. H. Lovell	779 45
Raymond Norton	10 00
George T. Watkins	50 00
Albert Pike	12 37
Ceylon Clark	80 25
Philip Studor	11 50
E L. McNair	362 22
J. H. Wheat	1,035 76
C. C. Bassett	2,275 69
J. M. Hatfield	75 77
R. B Hunter	22 50
A. H. Bumstead	594 15
George Perkins	133 39
H. D Humiston	35 00
W. J. Robinson	66 00
Glen. S. Smith	64 90
C. H. Semper	149 77
A. W. Gill	255 00
S. O. Scudder	160 00
J. V. Clute	150 00
M. H. Sanford	25 80
Henry S. Bender	44 00
J. H. Jennings	1,671 30
F. C Ingraham	135 00
Carlos Hutchins	42 00
D. E. Baxter	60 00
W. H. S. Morey	96 60
Evan W. Evans	50 00
J. F. Clark	16 20
H. M. Wilson	100 00
Helen Fields	10 00
F. N. Sanders	7 83
Edward Turk	172 26

Topographic Survey — State of New York — (Continued).

Name.	Total.
B. H Kent	$69 38
Melville Gillett	38 00
M. S Hungerford	40 95
Nat W. Shepard	68 00
Frank Baker	60 00
George Raymond	151 50
T. Whittleton & Son	86 38
Melvin Vedder	4 00
Isaac L. Huff	13 00
Geo W. Johnson	28 14
W. & L. E. Gurley	1 91
Nat. G. Van Doren	512 52
Jno. J. Wandell	530 50
Coxo & Glover	281 63
J. W. Thom	209 97
F. B. Smith	49 51
J. S. Topham	12 00
J. J. Andress	337 25
C. H. Bennett	231 97
C Tibbils	21 38
T. T. Craven	70 00
C. F. Horton	164 22
Geo A. May	27 75
Ashley McDonald	6 00
E. W. Prager	30 65
J. M. Whitman, Jr	210 00
Thos. D. Leonard	150 00
Jno J. Mabbett, Jr	30 00
A. J. Obertin	141 98
M. Earl	82 75
W. H. Glover	24 38
B. F. Rice	100 00
L. M. Lettis	50 00
L. D. Gardner	112 26
Chas. Davis	87 74
O. T Babcock	100 00
John Spaulding	60 00
J. M. Dimmick	16 94
M. E. Monahan	18 00
Chas. L. Hoopes	100 00
Jno. Wm. Ash	100 00
J. E. Thomas	100 00
Francis T. Fitch	60 00
H. B. Paige	100 00
Seth M. Van Loan	125 00
W. F. Hammond	91 22
S. E. Bacon	26 88
C. B. Bailey	90 97
W. E. Greene	120 00
R P. Tarr	24 19
H. M. Lockwood	43 55
Byron E. White	40 00
Hastings & McCarthy	15 00
Joseph Malone	99 75
J. L. Taylor	106 50
C. J. Hamlin	54 71
P Heffron	24 26
Gorham Benedict	10 88
J. L. Senior	29 03
H. N. Bain & Co	108 00
L. & H. Hornbeck	52 00
E. S. Cox	13 50
Fred Whittemore	41 94
Milo B. Daniels	50 00
E. J. Guiles	30 75
Jas. McCormick	71 76
	$20,297 84

STATEMENT SHOWING NAMES, RANK, ETC.

Improvement Public Highways.

(Chapter 115, Laws of 1898, and Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
T. C. Leutze	First asst. engineer	26	$6 00	$156 00	$106 42	$262 42
H. A. Van Alstyne	First asst. engineer	15	6 00	90 00	18 03	108 03
H. A Van Alstyne	Assistant engineer	20	5 00	100 00	4 26	104 26
Douglas Cornell	Assistant engineer	13	5 00	65 00	43 13	108 13
W. L Lawton	Assistant engineer	91	5 00	455 00	18 46	473 46
C. C. Huestis	Assistant engineer	8	5 00	40 00	10 45	50 45
Dorlon Clark	Assistant engineer	32	5 00	160 00	14 57	174 57
Marcus H. Ranney	Assistant engineer	76	5 00	380 00	190 92	570 92
F. N. Sanders	Leveler	53	4 50	238 50	4 20	242 70
Ralph Russell.	Leveler	53	4 50	238 50	12 50	251 00
Frederick S. Strong	Leveler	14	4 50	63 00	45 96	108 96
T. A. Hendrickson	Leveler	296	4 50	1,332 00	81 96	1,413 96
L. B. Jones	Leveler	27	4 50	121 50	18 01	139 51
Frank Roberts	Rodman	146	3 50	511 00	200 06	711 06
H. J. Richardson	Rodman	33	3 50	115 50	36 98	152 48
H. W. Degraff	Rodman	28	3 50	98 00	44 36	142 36
W. J. Gilmour	Rodman	23	3 50	80 50	23 29	103 79
Geo. A. Ensign	Rodman	60	3 50	210 00	100 78	310 78
C. M. Pepson	Rodman	10	3 50	35 00	14 56	49 56
R. M. Booth	Chainman	33	3 50	115 50	12 17	127 67
Parkes D. Wendell	Chainman	37	3 50	129 50	15 88	145 38
William Van Epps	Chainman	215	3 00	645 00	5 89	650 89
James T. Brady	Chainman	34	2 50	85 00	34 46	119 46
F. H. Lomax	Chainman	32	2 50	80 00	19 75	99 75
H. A. Knapp	Chainman	44	2 50	110 00	4 70	114 70
George McDonald	Chainman	....	....	....	10 87	10 87
W. W. Borst	Labor	31	3 50	108 50	....	108 50
John J. Carney	Labor	46	3 00	138 00	42 93	180 93
Ambrose Waite	Labor	18	2 00	36 00	44 85	80 85
Harry Bowen	Labor	76	2 00	152 00	143 03	295 03
F. L Mallory	Labor	53	2 00	106 00	89 25	195 25
L. R. Reis	Labor	23	2 00	46 00	38 16	84 16
H. T. Kinch	Labor	35	2 00	70 00	50 12	120 12
C. H. Mattison	Labor	23	2 00	46 00	45 50	91 50
						$7,903 46

Incidental expenses.

Telephone and telegraph	$26 50	
Postage	6 48	
Office rent	80 00	
Stationery	101 90	
Livery	840 50	
Miscellaneous	267 39	
		1,322 77
		$9,226 23

The foregoing tables are summarized as follows:

Ordinary Repairs.

1	Erie Canal, Chapter 550, Laws of 1898, and Chapter 569, Laws of 1899....	$10,804 06	
2	Champlain Canal, Chapter 550, Laws of 1898, and Chapter 569, Laws of 1899	5,372 59	
			$16,176 65

Extraordinary Repairs.

3	Erie Canal, Chapter 506, Laws of 1898, and Chapter 208, Laws of 1899....	$2,931 66	
4	Champlain Canal, Chapter 506, Laws of 1898, and Chapter 208, Laws of 1899..........	967 69	
5	Building stone arch culvert, Erie Canal, at Little Falls, N. Y., Chapter 91, Laws of 1899..........	401 58	
6	Improvement Erie Canal, Chapter 79, Laws 1895, Chapter 794, Laws 1896, Chapter 43, Laws 1897, Chapter 569, Laws 1897..........	400 72	
7	Improvement Champlain Canal, Chapter 79, Laws 1895, Chapter 794, Laws 1896, Chapter 43, Laws 1897, Chapter 569, Laws 1897	541 55	
8	Rexford Flats Dam, Erie Canal, Chapter 560, Laws 1895, Chapter 947, Laws 1896, Chapter 566, Laws 1897..........	256 87	
9	Fort Plain lift bridge, Erie Canal, Chapter 576, Laws of 1897..........	777 92	
10	Repairs to Moyer Creek banks, bed and drops, Chapter 128, Laws of 1898	258 00	
11	Bridge German Street, Erie Canal, Little Falls, N. Y., Chapter 680, Laws of 1895	245 00	
12	Bridge over Erie Canal, Town of Minden, Chapter 569, Laws of 1899....	93 39	
13	Lift bridge over Erie Canal at Canajoharie, N. Y., Chapter 477, Laws of 1899..........	40 61	
14	Bridge over Champlain Canal at Ontario street, Cohoes, N. Y., Chapter 613, Laws of 1899	85 65	
15	Bridge over Glens Falls feeder, Main street, Sandy Hill, N. Y., Chapter 623, Laws of 1898	126 94	
16	New blue line maps, Erie, Oswego & Champlain Canals, Chapter 569, Laws of 1899..........	184 50	
			7,312 08

Special Work.

17	Dyke on Neversink River, Town of Deer Park, Orange County, N. Y., Chapter 291, Laws of 1897..........	$72 00	
18	Removing obstructions and erection of a dam on Raquette River near Raymondville, St. Lawrence Co., Chapter 569, Laws 1899.	172 00	
19	Building a wall at Washington's Headquarters, at Newburgh, N. Y., Chapter 606, Laws of 1898	177 79	
20	Changing channel, Bashas Kill Stream, Sullivan County, N. Y., Chapter 621, Laws 1898	351 40	
21	Building dam across the Saranac River, at Saranac Lake, N. Y., Chapter 627, Laws of 1898	568 90	
22	Repairs to draw bridge, Minisceongo Creek, Rockland County, N. Y., Chapter 631, Laws of 1898..........	369 71	
23	Deepening and widening canal between Shinnecock and Great South Bay, Chapter 207, Laws 1898	813 08	
			2,524 88

Special Survey.

24	Surveys and maps for State Board of Claims, Chapter 606, Laws 1898, and Chapter 569, Laws 1899	$6,708 84	
25	Copying and preserving old maps, surveys notes, etc., Chapter 569, Laws 1899	574 50	
26	Old records, maps and surveys, Chapter 790, Laws of 1897..........	879 70	
27	Making maps, shore lines, Westchester County, Chapter 950, Laws 1896, and Chapter 569, Laws 1899..........	1,415 66	
28	Examination monuments, maps, etc., Chapter 606, Laws 1898, and Chapter 569, Laws of 1899..........	3,188 59	
29	Boundary line, Lewis and Herkimer Co's., Chapter 569, Laws of 1899...	5,244 45	
30	Topographic survey, State of New York, Chapter 219, Laws of 1898, and Chapter 96, Laws 1899	20,297 84	
31	Improvement of Public Highways, Chapter 115, Laws of 1898, and Chapter 569, Laws of 1899..........	9,226 23	
			47,535 81
			$73,549 37

Table of Contracts on Eastern Division Completed During the Year Ending September 30, 1899.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	LEGISLATIVE ACT.		Engineer's estimate at contract prices.	Final estimate.	Remarks.
				Chapter.	Year.			
Rochester Bridge and Iron Works....	Nov. 16, 1895	Constructing new iron bridge and abutments at German street, Little Falls, N. Y.	$8,000 00 4,946 50	680 573	1895 1897	$7,445 40	$8,075 68	
Whalen & Higgins	Sep. 14, 1897	Rebuilding apron and repairing dam across Mohawk river at Rexford Flats	20,000 00 9,424 00 7,644 00 8,234 75	560 947 566 550	1895 1896 1897 1898	25,981 50	34,283 90	Balance of appropriation used by Supt. of Public Works for repairing fishway in 1895.
P. J. Brummelkamp	Aug. 28, 1897	Repairs to Shinnecock and Peconic canal	(Agreement)	791	1897	....	4,499 06	
Hilton Bridge Construction Co	July 27, 1897	Constructing lift bridge at Railroad street, Ilion, N. Y.	18,000 00	105	1897	13,678 20	16,409 69	
Lauer & Hagaman	Nov. 17, 1896	Improvement of the Eastern Division of the Erie canal from lock 27 to lock 28, a distance of 5.21 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	74,159 35	127,946 10	
Brummelkamp, Lane & Co	Nov. 16, 1896	Improvement of the Eastern Division of the Erie canal from lock 32 to lock 33, a distance of 5.11 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	98,434 85	130,025 42	
J. W. Whalen	Nov. 10, 1896	Improvement of the Eastern Division of the Erie canal from lock 20 to lock 21, a distance of 3.22 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	52,910 50	80,845 20	
Joseph H. Conners	Feb. 21, 1899	Rebuilding a portion of culvert No. 39 on the Erie canal	850,000 00	506	1898	5,090 40	4,277 00	
The Callanan Road Improvement Co.	Sep. 7, 1898	Improvement of the Troy and Schenectady road in the county of Schenectady, N. Y.	50,000 00	115	1898	14,590 00	14,590 00	
Edward A. Matthews	Oct. 25, 1898	Improvement of the New Lebanon and Pittsfield road in the county of Columbia, N. Y.	50,000 00	115	1898	7,200 00	7,200 00	
Lauer & Hagaman	Nov. 17, 1896	Improvement of the Eastern division of the Erie canal from lock 33 to lock 34, a distance of 2.57 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	48,831 25	66,896 99	

John V. Quackenbush	Sep. 21, 1897	Improvement of the Eastern division of the Erie canal from lock 45 to the east line of Oneida county, a distance of 6.77 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	181,988 00	82,146 06
Clinton Beckwith	Sep. 21, 1897	Improvement of the Eastern division of the Erie canal from lock 40 to lock 41, a distance of 2.64 miles	9,000,000 00	79 794 43 & 569 506	1895 1896 1897 1898	53,000 00	14,847 25
Clinton Beckwith	Sep. 21, 1897	Improvement of the Eastern division of the Erie canal from lock 39 to lock 40, a distance of 2.76 miles	9,000,000 00	79 794 43 & 569 506	1895 1896 1897 1898	69,829 00	59,913 02
Brummelkamp, Lane & Co	May 26, 1899	For changing the channel of the stream in the town of Mamakating, Sullivan county, known as the Bashas Kill and Pine Kill at their junction	5,000 00	621	1898	3,780 00	2,953 93
William Coats	Aug. 7, 1899	For removing obstructions from the Raquette river and erection of a dam near Raymondville, St. Lawrence county, N. Y	2,500 00	569	1899	2,268 00	2,268 00

Table of Contracts Pending on the Eastern Division, September 30, 1899.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	Legislative Act.		Engineer's preliminary estimate	Engineer's estimate at contract prices	Payments to date
				Chapter.	Year.			
E. W. Wicks	June 14, 1898	Dredging channel between Shinnecock and Great South Bay in the town of Southampton, Suffolk county	$10,000 00	567	1898	$8,500 00	$5,440 00	$5,174 00
Gillett, Hay & Gillett	May 16, 1899	Repairing the draw bridge over the Minisceongo creek, Rockland county, N. Y.	6,000 00	411	1898	5,045 00	4,900 00	5,998 00
Gillett, Hay & Gillett	May 1, 1899	Building a dam across the Saranac river at Saranac lake, N. Y.	10,000 00	597	1898	9,880 00	7,098 00	9,510 00
George A. Rogers	July 21, 1899	Improvement of the Troy and Brunswick road in the county of Rensselaer, N. Y.	50,000 00	115	1898	8,171 00	5,075 00	9,488 88
John Twomey	July 5, 1899	Building a wall at Washington's headquarters at Newburgh, N. Y.	5,000 00	606	1898	4,165 00	5,097 00	2,880 00
Hallinan Bros	Aug. 8, 1899	Construction of a stone arch culvert for a channel leading from Waste Weir, No. 16, just west of Lock No. 36, Little Falls, N. Y.	6,000 00	91	1899	5,009 00	4,480 00	1,804 00
George A. Rogers	July 21, 1899	Improvement of Troy and Greenbush road in the county of Rensselaer, N. Y.	50,000 00	115	1899	9,886 00	7,917 80	880 00
Monty, Higley & Barber	April 21, 1899	Constructing a steel bridge and abutments over the Glens Falls feeder on Main street in the village of Sandy Hill, N. Y.	6,000 00	594	1898	5,894 00	5,445 90	.....

Table of Contracts on the Eastern Division upon which work was stopped by order of Superintendent of Public Works and State Engineer, April 26, 1898. *Last accounts in hands of the Canal Board for adjustment September* 30, 1899.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Appropriation.	LEGISLATIVE ACT.		Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payments to date.
				Chapter.	Year.			
Mahan & Sundstrom	Nov. 12, 1896	Improvement of the Champlain Canal between Lock 15 and Lock 16, a distance of 11.75 miles	$9,000,000 00	79 794	1895 1896	$245,188 76	$214,317 52	$219,375 00
John V. Quackenbush	Sept. 21, 1897	Improvement of the Eastern Division Erie Canal from Lock 41 to Lock 42, a distance of 2.86 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	73,450 50	59,290 50	56,541 75
Troy Public Works Co.	Sept. 16, 1897	Improvement of the Eastern Division Erie Canal from Lock 25 to Lock 27, a distance of 6 59 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	149,280 00	132,678 00	93,024 00
Lauer & Hagaman	Oct. 13, 1897	Improvement of the Erie Canal from Lock 24 to Lock 25, a distance of 3.8 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	91,905 00	97,301 00	76,430 70
Pulford & Compton	Nov. 8, 1897	Improvement of the Champlain Canal from Lock 20 to Lock 21, a distance of 5.44 miles	9,000,000 00	79 794 43 & 569	1895 1896 1897	85,570 00	64,249 50	36,297 00
Baker, Banker, Hingston & Co.	Nov. 11, 1897	Improvement of the Champlain Canal from Lock 17 to Lock 20, a distance of 6.8 miles.	9,000,000 00	79 794 43 & 569	1895 1896 1897	88,294 00	34,017 00	18,425 00

REPORT

OF THE

DIVISION ENGINEER

OF THE

MIDDLE DIVISION

For the Fiscal Year Ending September 30, 1899.

Middle Division.

Division Engineer's Office,
Syracuse, N. Y., *October* 1, 1899.

Hon. Edward A. Bond, *State Engineer and Surveyor, Albany:*

Dear Sir.—I have the honor herewith to submit my annual report for the Middle Division of the New York State canals for the fiscal year ending September 30, 1899:

ENGINEERING DEPARTMENT.

This Department has been under the charge of W. H. H. Gere, division engineer; and George A. Morris, resident engineer, until January 31, 1899, since which time no resident engineer has been employed.

Table No. 1, hereto annexed, shows the names of the engineers duly appointed by the State Engineer and Surveyor, time employed, rate of compensation, and amount paid during the year, with the amount of other miscellaneous expenditures, for ordinary repairs, extraordinary repairs, improvement of public highways, special appropriations and special surveys.

Table No. 2, exhibits contracts in force under special appropriations at the close of the fiscal year, together with engineer's estimate of cost, engineer's estimate at contract prices and payments to September 30, 1899, for each piece of work and amount paid thereon.

Table No. 3, exhibits contracts under special appropriations, completed and settled during the fiscal year, showing appropriation, engineer's estimate at contract prices, and final account.

Table No. 4, exhibits contracts for the improvement of the canals under chapter 79, Laws of 1895, completed and settled during the fiscal year, showing engineer's estimate and amount of final account.

Table No. 5, exhibits statement of contracts under chapter 79, Laws of 1895, suspended May 14, 1898, for lack of funds, showing engineer's preliminary estimate, engineer's estimate at contract prices, payments to September 30, 1899, and total amount of work done.

Table No. 6, exhibits statement of the improvement of public highways, showing engineer's preliminary estimate, engineer's estimate at contract prices and payments to September 30, 1899.

Table No. 7, exhibits water record of Cayuga and Cross lakes and Seneca river, taken tri-annually since 1884, in pursuance of concurrent resolutions of the Senate and Assembly, passed in 1884.

EXTENT OF THE MIDDLE DIVISION.

	Miles.	Total.
This Division comprises that portion of the Erie canal lying between the east lines of Oneida county and the south line of Wayne county...	97.02	
Also the following unabandoned lateral canals:		
Oswego canal, from Syracuse to Oswego.......	37.78	
North and south side-cuts and slips at Salina...	2.02	
Slips at Liverpool, Oswego canal..............	0.25	
Baldwinsville side-cut	0.59	
Cayuga and Seneca canal, Montezuma to Cayuga and Seneca lakes..........................	22.99	
Black River canal, Rome to Lyons Falls........	35.52	

	Miles.	Total.
Old Oneida Lake canal, Higginsville to first lock	1.05	
Chenango canal, from Erie canal to Fayette street	0.05	
Chemung canal, lake level	2.53	
		199.80
RIVER IMPROVEMENTS.		
Black river, Lyons Falls to Carthage	42.50	
Onondaga outlet, Onondaga lake to Seneca river	0.75	
Oneida river, Three River Point to Brewerton and Oneida lake	20.00	
Seneca river towing-path, Mud lock to Baldwinsville	5.83	
Seneca river, Baldwinsville to Jack's Reefs (not used)	11.75	
Ithaca inlet, Cayuga lake to Ithaca	2.05	
Seneca lake outlet, from Cayuga and Seneca canal to Seneca lake	0.17	
		83.05
NAVIGABLE FEEDERS.		
Limestone creek feeder, Erie canal to Fayetteville	0.83	
Butternut Creek feeder, Erie canal, to feeder dam above Dunlap's mills	1.67	
Camillus feeder, Erie canal, to Camillus	1.04	
Delta feeder, foot of Lock No. 9, Black River canal, to Delta	1.40	
Black River feeder, Boonville, to head of pond at Forestport	11.29	
		16.23
Total		299.08

ARTIFICIAL FEEDERS—NOT NAVIGABLE.

	Miles.
Chenango canal, summit level	5.31
Leland pond feeder	0.31
Madison brook feeder	2.99
West Branch feeder	5.83
Bradley's brook feeder	0.67
Hatch's lake feeder	0.23
Kingsley brook feeder	1.87
Oriskany creek feeder	0.53
Mohawk feeder to Rome	0.03
Oneida creek feeder	2.91
Cowasselon creek feeder	0.40
Chittenango creek feeder	0.28
Cazenovia lake outlet (improved)	0.51
Tioughnioga river feeder	1.00
De Ruyter reservoir outlet	0.12
Orville feeder (unnavigable portion)	0.55
Camillus feeder (unnavigable portion)	0.65
Carpenter brook feeder	0.18
Skaneateles creek feeder	0.09
Putnam brook feeder	0.20
Centerport feeder	0.18
Owasco creek feeder (including 859 feet of iron pipe)	2.10
Lansing Kill feeder	1.80
Sugar river feeder	0.14
New outlet of Third Bisby lake	0.06
New outlet to Canachagala lake	0.16
Total	29.10

SOURCES OF WATER SUPPLY.

The canals upon this division are supplied with water from the following named sources:

Erie Canal—Frankfort and Rome Levels.

(Three and three hundred and fifty-six thousandths miles of Frankfort level on middle division. The Rome level, lock No. 46 to lock No. 47 equals 55.957 miles.)

	Cubic feet per minute.
Leland's pond, Madison Brook reservoir, Eaton Brook reservoir, Bradley Brook reservoir, Hatch's lake, Kingsley Brook reservoir and Oriskany creek, feed through the Chenango canal, Oriskany creek and Oriskany creek feeder into the Rome level, six miles west of lock No. 46	6,000
Mohawk river, Black river, Forestport pond, Forestport reservoir, White Lake reservoir, Chub lake, Sand lake, First, Second and Third Bisby lakes, Woodhull reservoir, Twin lakes, South Branch reservoir, North Branch reservoir, Canachagala lake feed through the Rome feeder and Black River canal into the Rome level at Rome, 14 miles west of lock No. 46	13,000
Oneida creek enters canal through feeder, 30 miles west of lock No. 46	1,000
Cowasselon creek enters canal through feeder, 31½ miles west of lock No. 46	200
Cazenovia Lake reservoir (for 100 days), Erieville reservoir (for 100 days) and Chittenango creek enter canal through Chittenango Creek feeder, 41½ miles west of lock No. 46	5,641

	Cubic feet per minute.
DeRuyter reservoir (for 100 days) enters canal through Limestone Creek (Fayetteville) feeder, 50 miles west of lock No. 46	3,891
Limestone creek (natural flow) enters canal through Limestone Creek (Fayetteville) feeder, 50 miles west of lock No. 46	500
Jamesville reservoir (for 60 days) enters canal through Orville feeder, 52 miles west of lock No. 46	2,000
Butternut creek (natural flow) enters canal through Orville feeder, 52 miles west of lock No. 46	500
Total	32,732

Short level, from lock No. 47 to No. 48=.188 of a mile, fed from Rome level.

Mile level, from lock No. 48 to No. 49=.714 of a mile, fed from Rome level through short level.

Syracuse level, from lock No. 49 to No. 50=5.014 miles, fed from Rome and Jordan levels.

Jordan level, from lock No. 50 to No. 51=14.903 miles.

	Cubic feet per minute.
Otisco Lake reservoir feeds through Camillus feeder into the canal four miles west of lock No. 50	5,146
Nine Mile creek (natural flow), fed through Camillus feeder into canal, four miles west of lock No. 50	800
Carpenter brook enters canal through feeder, 10 miles west of lock No. 50	200
Skaneateles Lake reservoir feeds into canal at Jordan, 13 miles west of lock No. 50	8,766
Total	14,912

Port Byron level, from lock No. 51 to 52=7.793 miles; from Jordan level, through lock No. 51.

	Cubic feet per minute.
Putnam Brook feeder, at Weedsport	200
Owasco Lake reservoir, through feeder at Port Byron	4,033
Total	4,233

	Cubic feet per minute.
Montezuma level, from lock No. 52 to Wayne county=9.098 miles; from Port Byron level through lock No. 52, and from Lake Erie	4,000

Oswego Canal.

	Cubic feet per minute.
Erie canal, at Syracuse	10,000
Seneca river	54,000
Oneida river	20,000
Total	84,000

Cayuga and Seneca Canal.

	Cubic feet per minute.
Seneca lake	18,000
Erie canal, at Montezuma	4,000
Total	22,000

SUMMARY OF WATER SUPPLY MEASURED.

Erie Canal.

	Cubic feet per minute. Amounts.	Total.
Frankfort and Rome levels	32,732	
Jordan level	14,912	
Port Byron level	4,233	
		51,877

	Cubic feet per minute Amounts.	Total.
Oswego Canal.		
From Seneca river	54,000	
From Oneida river	20,000	
		74,000
Cayuga and Seneca Canal.		
From Seneca lake	18,000	18,000
Total		143,877

THE FOLLOWING IS A BRIEF DESCRIPTION OF THE RESERVOIRS ON THE MIDDLE DIVISION.

De Ruyter Reservoir.—This reservoir is located sixteen miles south of the canal, and the feeder dam is located at Fayetteville. The average area of this reservoir is 626 acres. The average depth is 18 feet, 6 inches. It was first brought into use in 1863, and discharges its waters into the Erie Canal at Fayetteville.

Jamestown Reservoir.—This reservoir is located six miles south of the canal. The feeder dam is located on the outlet, two and a half miles from the canal. The average area of this reservoir is 240 acres. The average depth is 16 feet, 6 inches. It was first brought into use in 1863. Water from this reservoir is discharged into the Erie Canal at Orville.

Otisco Reservoir.—This reservoir is located 12 miles south of the canal and the dam and bulkhead are located on the creek leading from it, one and one-half miles from the canal, at the head of the feeder. The average area of this reservoir is 2,200 acres. The average depth is 10 feet. It was first brought into use in 1869, and discharges its waters into the Erie Canal at Camillus.

Skaneateles Lake Reservoir.—This lake reservoir is located 10 miles south of the canal and is controlled by a dam at the foot of the lake. The feeder dam is located near the canal in the village of Jordan. The average area of this reservoir is 8,320 acres. The average depth is nine feet. It was first brought into use in 1844, and discharges its waters into the Erie Canal at Jordan.

Owasco Lake Reservoir.—The reservoir dam is located about one and one-half miles below the foot of the lake. The feeder dam is located about two miles south of the canal just above Hayden's Mill in the city of Auburn. The average area of this reservoir is 6,800 acres. The average depth is two feet, six inches. It was first brought into use in 1875, and discharges its waters into the Erie Canal at Port Byron.

The Madsion County group of reservoirs consisting of Kingsley Brook, Eaton Brook, Hatches Lake, Bradley Brook, Madison Brook and Leland's Pond reservoirs are located in the southern part of Madision county, and were first brought into use in 1836. These reservoirs discharge first into the summit level of the abandoned Chenango Canal, thence into Oriskany creek, thence into the Erie Canal at Oriskany. The average area and depth of these reservoirs is as follows:

Kingsley Brook	113 acres, depth=20′—0″
Eaton Brook	254 acres, depth=50′—0″
Hatches Lake	134 acres, depth=10′—0″
Bradley Brook	134 acres, depth=25′—0″
Madison Brook	235 acres, depth=40′—0″
Leland's Pond	173 acres, depth= 8′—0″

Cazenovia Lake Reservoir.—This reservoir is located about 10 miles south of the Erie Canal. The feeder dam is located about one mile east of the lake. The average area of this reservoir is 1,778 acres. The average depth is four feet, six inches. It was first brought into use in 1857, and discharges its waters into the Erie Canal at Chittenango, through Chittenango creek.

Erieville Reservoir.—This reservoir is located about 15 miles south of the canal. The average area is 340 acres. The average depth is five feet. It was first brought into use in 1850, and discharges its waters into the Erie Canal at Chittenango, through Chittenango creek.

North Woods Reservoirs.—Woodhull, Sand Lake, Canachagala, Twin Lake, North Lake, South Lake, White Lake, Chub Lake and the Bisby's, are located near the head waters of the Black river, about fifty-two miles north of Rome. Forestport reservoir is about thirty miles north of Rome.

The average area, depth and the date when these reservoirs were first brought into use is as follows:

Woodhull, 1118 acres, depth 18′ 0″ first brought into use in 1860.
Sand lake, 306 acres, depth 15′ 0″ first brought into use in 1873.
Canachagala, 320 acres, depth 6′ 0″ first brought into use in 1881.
Twin lake, 175 acres, depth 8′ 0″ first brought into use in 1881.
North lake, 277 acres, depth 26′ 0″ first brought into use in 1857.
South lake, 372 acres, depth 27′ 0″ first brought into use in 1861.
*White lake, 296 acres, depth 5′ 0″ first brought into use in 1882.
†Chub lake, 530 acres, depth 25′ 0″ first brought into use in 1882.
*The Bisbys, 2755 acres, depth 3′ 6″ first brought into use in 1881.
Forestport, 700 acres, depth 7′ 0″ first brought into use in 1894.

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[*] White Lake and the Bisbys were abandoned by act, chap. 274, Laws of 1899.

[†] Chub Lake was abandoned in 1856.

Fulton Chain.

The flow line area of First lake is 403 acres, first brought in use 1882.

The flow line area of Second lake is 175 acres, first brought in use 1882.

The flow line area of Third lake is 166 acres, first brought in use 1882.

The flow line area of Fourth lake is 1,979 acres, first brought in use 1882.

The flow line area of Sixth lake is 109 acres, first brought in use 1882.

The flow line area of Seventh lake is 867 acres, first brought in use 1882.

The above reservoirs discharge their waters into the Black river, and are not used to supply water for the Erie canal.

IMPROVEMENT OF THE ERIE AND OSWEGO CANALS.

During the past fiscal year no work has been done under the several contracts, but it has required a great amount of labor of this Department to make the necessary drawings, computations and entering all the field notes in proper form as required by law to make up the final accounts for work done previous to the general order of suspension. This work is now nearly completed, and the expense has been paid from our ordinary repair fund to the extent of over $15,000, thus crippling this Department in the prosecution of our legitimate duties in connection with ordinary repairs. An increased appropriation of at least $5,000, to ordinary repair fund for engineering expenses of the Middle division should be made to enable this Department to meet all demands upon it for the next fiscal year.

NAVIGATION.

The work done under improvement contracts has very much improved the navigation of the Middle division.

The entire length of the Middle division of the Erie, with the exception of about 22 miles, has been bottomed out to new grade and eight feet of water has been maintained in 67 miles, and nine feet in Syracuse and Utica levels, a distance of eight miles.

The portion remaining to be bottomed out is in several sections on the long level between Syracuse and Utica.

The improvement of the Jordan level is especially appreciated by boatmen, as formerly it was with the utmost difficulty, fully loaded boats could be moved over the summit level, but now all pass with no danger of touching bottom or delay of any kind.

No breaks, delaying the navigation of the Erie canal has occurred.

On September 18th a disastrous break occurred in the towing path bank of Forestport feeder, just below the place of the break of July 23, 1897, the undoubted result of an evil disposed person. The bank at the place the break occurred, is built of sand, about 70 feet in height, and it is only necessary to open a channel across the bank to water surface, after that is done the 11 miles of water in the feeder will soon carry the bank into the Black river adjoining. In this case the break was discovered early, and by great effort the officers in charge were able to prevent much of the bank being carried out, but it required 17 days, with a large force working night and day to make the necessary repairs.

While this feeder supplies much of the water required to maintain the long level, and during the repairs the Black river canal was of necessity closed, no water from the Black river could be delivered to the Erie canal, yet with the abundant supply in other storage reservoirs, the Erie canal was kept in navigable condition without hindrance.

EXTRAORDINARY REPAIRS.

The following is a brief description of work done under contract under the supervision of the Engineering Department during the past fiscal year.

CONTRACTS IN FORCE.

Dredging Cayuga and Seneca Canal and Harbor at Cayuga.

This work was authorized by chapter 606, Laws of 1898.

Appropriation, $10,000.

Was let August 2, 1899, to G. D. Grannis.

Amount of bid, $7,025.

The work consists of dredging the basin below lock No. 11 and extending into the lake to secure proper depth of water for navigation, also excavating the prism of canal proper from lock No. 11 to junction of main canal, a distance of about two miles. This portion of the canal had become filled by the accumulation of years, so that navigation by fully laden boats was extremely difficult. Amount of payment for work done, $892.50.

Constructing Vertical Walls, etc., at Fulton, N. Y.

This work was authorized by the Canal Board, to be paid from chapter 113, Laws of 1897, and chapter 477, Laws of 1899.

Appropriation, $2,766.14.

Was let July 18, 1899, to Walter Bradley & Co.

Amount of bid, $12,179.

The work consists of constructing about 300 feet of vertical wall on tow-path side of canal, building cross-walks, pointing old masonry, erecting gas-pipe railings at the new bridge at First and Oneida streets, Fulton, N. Y.

This work will be commenced at once and completed during suspension of navigation next winter. No payments have been made.

Constructing a Bulkhead and Gates at Head of Mill Canal, at Fulton.

This work was authorized by the Canal Board to be paid from chapter 208, Laws of 1899.

Was let September 18, 1899, to Walter Bradley & Co.

Amount bid, $2,611.

This work consists of reconstructing bulkhead of oak timber across the head of mill canal at Fulton and inserting proper gates to supply mills with power. No payments have been made.

The reconstruction of this bulkhead was made necessary in consequence of the old structure being carried away while the channel below was empty, and being enlarged by the mill owners to increase their supply of water. This structure has been maintained by the State to enable boats to cross the Oswego river to mills upon the west side of Oswego river.

The failure of the bulkhead in no way obstructed navigation of Oswego canal, but will be rebuilt at once.

Rebuilding Locks No. 47 *and* 64—*Black River Canal.*

The rebuilding of these locks was authorized by the Canal Board to be paid from chapter 208, Laws of 1899.

Were let September 11, 1899, to Walter Bradley & Co.

Amount of bid, $15,776.30 for each lock.

This work consists of rebuilding the two locks of cut limestone with stone masonary backing.

Many of the old locks are likely to fall from the disentegration of the face stone, and I repeat my former recommendations in regard to these locks—that at least six locks should be rebuilt each year until all between Rome and the summit have been rebuilt.

The following locks have been rebuilt under former contracts, to wit:

Lock No. 1, in 1891, cost	$12,120 35
Lock No. 8, in 1888, cost	10,839 75
Lock No. 12, in 1889, cost	16,608 57
Lock No. 18, in 1895, cost	17,502 90
Lock No. 28, in 1896, cost	17,574 51
Lock No. 37, in 1895, cost	14,619 36
Locks No. 39, 40 and 41, in 1896, cost	37,958 24
Lock No. 48, in 1888, cost	9,274 50
Lock No. 49, in 1897, cost	16,899 19
Lock No. 51, in 1898, cost	16,137 64
Lock No. 55, in 1898, cost	19,281 47
Lock No. 60, in 1889, cost	15,533 85
Lock No. 76, in 1893, cost	12,706 69
Lock No. 96, in 1897, cost	19,521 93

Locks No. 47 and 64 are now under contract.

Completing Approaches to Bridge Over the Inlet to Otisco Lake.

This work was authorized by chapter 615, Laws of 1898.

Appropriation, $10,000.

Was let May 29, 1899.

Amount of bid, $6,943.00

This work consists of completing the embankment across the head of Otisco lake to provide a highway above high water and protecting the bank upon each side with slope wall.

Under this contract the highway will be completed and no further appropriation will be needed.

The amount of payments made to date is $1,666.

The work is progressing and will be completed January 1, 1900.

Repairing Bridge at Foot of Liberty Street, Penn Yan.

This work was authorized by chapter 190, Laws of 1898.

Appropriation, $1,500.

Was let May 29, 1899.

Amount of bid, $1,182.

This work consists of repairing the iron bridge over the outlet of Crooked lake, at the foot of Liberty street in the village of Penn Yan, by substituting a steel floor system in place of timber which had become too decayed for safety.

The work will be done by December 1, 1899.

Lift Bridge at Peterboro Street, Canastota.

This work was authorized by chapter 626, Laws of 1898.

Appropriation, $18,000.

Was let May 31, 1899.

Amount of bid, $15,639.10.

This contract provides for the removal of the present overhead structure and the construction of a lift bridge.

There has been no work done under this contract further than contracting for materials to be used in the work.

The structure will no doubt be completed by the opening of navigation next spring.

Lift Bridge Over the Erie Canal at Schuyler Street, Utica.

This work was authorized by chapter 427, Laws of 1898.

Appropriation, $18,000.

Was let April 21, 1899.

Amount of bid, $10,480.

This work consists of erecting a lift bridge over Lock No. 46, in line of Schuyler street.

Nothing has been done under the contract further than securing materials.

The structure will be completed before opening of navigation next spring.

CONTRACTS COMPLETED AND SETTLED.

Vertical Retaining Walls on Oneida Feeder.

This work was authorized by chapter 633, Laws of 1898.

Appropriation, $8,000.

Was let March 23, 1899.

Amount of final account, $4,641.96.

This work consisted of constructing vertical walls on each side of Oneida feeder, in the village of Oneida, from Messenger street to Cedar street.

The work is completed and final account rendered.

Lift Bridge at Salina Street, Syracuse.

This work was authorized by chapter 571, Laws of 1897.

Appropriation by State, $18,000.

Appropriation by city, $18,000.

Was let February 24, 1898.

Amount of final account, $30,694.65.

This bridge takes the place of the old swing structure which had been in use for many years, and had become entirely inadequate to accommodate the travel upon the street.

The present structure has a roadway 40 feet wide with two sidewalks 10 feet wide each.

Lift Bridge at Whitesboro Street, Utica.

This work was authorized by chapter 563, Laws of 1897.

Appropriation by State, $10,000.

Appropriation by city, $10,000.

Was let February 24, 1898.

Amount of final account, $20,676.57.

A provision in the law authorized the Superintendent of Public Works to pay any deficiency in the appropriation from any money not otherwise appropriated, not to exceed the sum of $5,000. The deficiency amounts to $676.57, together with the cost of engineering inspection and printing.

The old overhead structure was removed and the new bridge erected in its place.

Lift Bridge at Broad Street, Utica.

This structure was authorized by chapter 565, Laws of 1897.

Appropriation by the State, $20,000.

Appropriation by the city, $5,000.

Amount of final account, $17,022.28.

This structure was erected in place of an overhead bridge which had been in use many years.

Repairing and Protecting Banks of Oriskany Creek.

This work was authorized by chapter 620, Laws of 1898.

Appropriation, $1,500.

Amount of final account, $879.58.

This work consisted of repairing and protecting the banks with rip rap of Oriskany creek, in the town of Kirkland near the village of Clinton, to prevent the overflow of banks in time of high water in the creek, which is no way produced by the operations of the State.

Light House at Cayuga.

This structure was authorized by chapter 425, Laws of 1898.

Appropriation, $400.

Final account, $346.

This light house was constructed of steel upon the pier at Cayuga, at the foot of Cayuga lake, to enable boats to enter the harbor in the night time in place of an old wooden structure that had become too dilapidated for further use.

IMPROVEMENT OF PUBLIC HIGHWAYS.

Deerfield Road No. 3.

This work was let October 4, 1898, to J. J. Dwyer & Co. for $13,806.35.

The portion of road to be improved extends from Deerfield Corners, near Utica, east to the east line of Oneida county, a distance of two and one-quarter miles. It was put under contract so late in the season of 1898 that it could not be completed before fall rains set in, and the limestone base was put in place for 5,100 feet at west end of the road, and some grading was also done on the remaining portion.

After the spring opened work was recommenced and continued until finished. Under the specifications trap rock screenings was to be used as a binder for top course of trap rock. Before that part of the work was reached it was discovered on other roads being built under similar specifications that trap rock screenings would not set, however much wetting and rolling might be done upon the surface. Quite an amount of trap rock screenings had been delivered on the work, which had to be discarded and limestone screenings substituted.

With proper limestone as a binder, the surface became smooth and hard, fully justifying the change. The road is completed.

Cortland Street Road No. 8.

This work was let July 6, 1899, to Clark & Hibbard for $4,375.

The portion of road to be improved extends from Candee's Hotel, at Onondaga Valley, to Dorwin Spring, Onondaga county, a distance of 1.3 miles.

The work was commenced promptly and prosecuted with fair dispatch. The improvement of this road was authorized under the provision of laws providing for petition of adjoining property owners, and the petition limited the cost of the road at $5,000.

In order to construct the road within the limit ($5,000) it was necessary to use local limestone for top dressing and the specification were so prepared and the work was prosecuted upon that plan until it was found that limestone would not bear sufficient rolling without crushing into dust to make a sufficiently hard surface. This condition was so obvious that the local authorities called a meeting of the board of supervisors on the 14th day of September and passed a resolution authorizing and directing the State Engineer and Surveyor to add to the contract of Clark & Hibbard a top course of trap rock three inches in depth and 15 feet in width, with Tompkin's Cove limestone screenings for binder at an additional cost of $6,828.

A supplemental contract was entered into with Clark & Hibbard, dated September 21, 1899, in accordance with the action of the Board of Supervisors.

James Street Road No. 9.

This work was let July 1, 1899, to Fred O. Sterling for $3,450.

The portion of road to be improved extends from the east line of the village of Eastwood to the westerly bounds of the village of East Syracuse, in the county of Onondaga, a distance of .58 of a mile.

The estimate and specifications of this road were made upon the same basis as the Cortland Street road, with the same results.

The board of supervisors at their meeting on the 14th day of September also authorized and directed the State Engineer and Surveyor to surface the road with trap rock fifteen feet in width, with Tompkin's Cove screenings for binder, at an additional cost of $3,265.

From experience thus far gained in the construction of good roads, I advise that no contract be let for a macadam road, except provision be made for trap rock stone finishing course of at least two inches after rolling, using limestone screenings for binder, and for roads of importance enough to be improved with State aid the stone metal should be not less than fifteen feet in width, properly crowned, with wings at least three feet and the sides well ditched and drained.

The importance of starting work in early spring and only so much work undertaken as can be fully completed by October 15th should be undertaken to secure best results is fully demonstrated.

The limited extent of roads improved under the State Aid Laws are appreciated by the people using them, and when appropriations are made in sufficient amount to encourage efforts to secure good roads the number of applications will be increased, and funds set aside in behalf of the State will be fully exhausted and our public highways will be a credit to the people.

The object lessons so far furnished are teaching the people what to hope for in the near future if the Legislature provides funds as contemplated by Act chapter 115, Laws of 1898.

The importance of keeping travel off a road while the work of construction is being done is fully demonstrated by the trouble and damage experienced by contractors on roads already built. Authority should be given to commissioners of highways in towns to close a road to public travel while the improvement is being made, thereby saving the contractor much expense which he must anticipate by increasing price when bidding for the contract, and the quality of the work suffers by being cut up by teams and vehicles while being rolled and finished.

BENCH MARKS.

Before commencing work upon the improvement of the canal under chapter 79, Laws of 1896, it was necessary to establish permanent and reliable bench marks at intervals along the whole line, from which datum could be readily taken at any time.

Great care and expense was expended to make the recorded elevations absolutely accurate, as upon their reliability depended the correctness of the work to be done.

In order that these bench marks may become a matter of record for future reference the following table is appended hereto.

Several of the benches as at first established have been disturbed during the prosecution of the improvement work, and all such have been transferred with care to other points, so that those enumerated may safely be depended upon as reliable in all future construction or repairs.

SURVEY OF SENECA LAKE.

This work was authorized by chapter 501, Laws of 1899.

Appropriation, $5,000.

On June 26th a party was organized and put in the field " for the purpose of ascertaining the present levels of said lake and the levels of the waters of the outlet thereof at a point two feet above the crest of the present dam at Waterloo, and also to prepare plans and specifications and estimate of cost for the purpose of erecting such structures as may be necessary to provide an additional storage of the waters of Seneca Lake to the height of two feet above the crest of the present dam at Waterloo."

The party was put in the immediate charge of David E. Whitford, who by his long experience is especially qualified for the work.

The labor of running contours at all points upon the margin of the lake that might be affected by the erection of any style of structure in the outlet of the lake is an undertaking of no small magnitude.

The survey has been continued to the close of the fiscal year, and it is believed the survey will be completed before December 1st, when the maps, plans and estimates will be prepared as provided by law.

Amount expended to September 30th, $1,817.62.

SURVEYS ON ACCOUNT OF ATTORNEY-GENERAL.

The improvement of the Erie and Oswego canals under chapter 79, Laws of 1896, left a legacy in shape of claims for damages along the whole line for lands temporarily and permanently taken for the improvement. To arrive at a just settlement of these claims a party was organized to make surveys and maps of all lands used or taken. The party have been steadily employed since August 1st and it will require uninterrupted work for the party until December 1st to complete the surveys and maps.

Amount expended to September 30th, $1,974.22.

CORNELL LAND SURVEY.

In compliance with the requirements of chapter 122, Laws of 1898, and by direction of the State Engineer and Surveyor, a party was organized under the immediate charge of Arthur O'Brien, Assistant Engineer, to make the survey required by said act, and the time required to perform the work extended from July 24th until September 30th, at which time the survey is nearly finished.

Amount expended to September 30th, $2,052.48.

In closing this report the Division Engineer desires to thank the State Engineer and Surveyor for his uniform courtesy and kindness during the first year of official intercourse.

All employees of the Department have shown in a marked degree their readiness to perform their full duty upon all occasions, and all have been entitled to, and have, the respect and confidence of each other and of their superior officers.

Respectfully submitted,

W. H. H. GERE,

Division Engineer.

TABLE No. 1.

STATEMENT SHOWING THE NAMES, RANK AND COMPENSATION OF ENGINEERS EMPLOYED ON THE MIDDLE DIVISION OF THE NEW YORK STATE CANALS, TOGETHER WITH THE INCIDENTAL EXPENSES FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1899.

Ordinary Repairs—Erie Canal.

(Chapter 435, Laws of 1897; Chapter 550, Laws of 1898; Chapter 569, Laws of 1899; Chapter 571, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$2,258 33	$97 33	$2,355 66
George A. Morris	Resident engineer	....	2,400 per yr.	640 00	137 85	777 85
Frank B Chapman	Confidential clerk	156	5 00	780 00	2 61	782 61
Reeves Smith	First ass't engineer	169	6 00	1,014 00	120 74	1,134 74
Guy Moulton	First ass't engineer	224	6 00	1,344 00	46 04	1,390 04
Arthur O'Brien	Assistant engineer	237	5 00	1,185 00	15 58	1,200 58
C E. Raynor	Assistant engineer	6	5 00	30 00	27 72	57 72
Paul L Schuetze	Assistant engineer	44	5 00	220 00	....	220 00
S. J Steward	Assistant engineer	26	5 00	130 00	....	130 00
D. E. Whitford	Assistant engineer	13	5 00	65 00	....	65 00
Noble E. Whitford	Assistant engineer	18	5 00	90 00	....	90 00
M. B. Palmer	Assistant engineer	22	5 00	110 00	....	110 00
W. J. Towne	Assistant engineer	21	5 00	105 00	....	105 00
Fred W. Sarr	Leveler	69	4 50	310 50	4 72	315 22
E. C. Clark	Leveler	57	4 50	256 50	2 40	258 90
Edwin Styring	Leveler	73	4 50	328 50	....	328 50
L. W. Hall	Leveler	18	4 50	81 00	....	81 00
E J. Berry	Leveler	20	4 50	90 00	....	90 00
Fred J. Wagner	Leveler	8	4 50	36 00	5 09	41 09
C. A. Young	Leveler	18	4 50	81 00	....	81 00
Fred. J. Wagner	Rodman	45	4 50	202 50	....	202 50
L. K. Devendorf	Rodman	196	3 50	686 00	1 58	687 58
George Rae	Draughtsman	49	3 50	171 50	6 18	177 68
C. K. Munroe	Chainman	170	5 00	850 00	45 56	895 56
D. E Whitford	Chainman	22	5 00	110 00	....	110 00
E. J. Berry	Chainman	196	4 50	882 00	51 01	933 01
W. H. Porter	Chainman	84	3 50	294 00	....	294 00
R. M. Booth	Chainman	15	3 50	52 50	11 92	64 42
P. P Wendell	Chainman	21	3 50	73 50	10 92	84 42
Howard Crounse	Chainman	330	3 00	990 00	7 23	997 23
George H. Thomas	Chainman	172	3 00	516 00	1 58	517 58
B. E. Turnbull	Chainman	83	2 50	207 50	5 80	213 30
H S. Van Valkenburg	Chainman	72	2 50	180 00	....	180 00
John C. Mulvihill	Chainman	28	2 50	70 00	1 20	71 20
John Schimmel	Chainman	4	2 50	10 00	....	10 00
						$15,053 39

Incidental expenses.

Labor	$1,107 68	
Livery	44 00	
Stationery	146 83	
Fuel and Light	309 24	
Postage	42 00	
Office rent	28 50	
Telephone and telegraph	410 47	
Miscellaneous	1,124 57	
		3,213 29
Total		$18,266 68

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Ordinary Repairs—Oswego Canal.

(Chapter 550, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$250 00	$0 70	$250 70
George A. Morris	Resident engineer	....	2,400 per yr.	160 00	....	160 00
Reeves Smith	First asst. engineer	32	$6 00	192 00	9 00	201 00
C. E. Hopkins	Leveler	22	4 50	99 00	4 50	103 50
						$715 20
Incidental expenses.						
Telephone and telegraph					$0 60	
Miscellaneous					10 95	
						11 55
Total						$726 75

Ordinary Repairs—Black River Canal.

(Chapter 505, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	..	$3,000 per yr.	$200 00	....	$200 00
Guy Moulton	First asst. engineer	4	6 00	24 00	$12 49	36 49
Eugene C. Olcott	Draftsman	29	4 50	130 50	....	130 50
D. E. Whitford	Chainman	83	5 00	415 00	28 91	443 91
						$810 90
Incidental expenses.						
Miscellaneous						14 75
Total						$825 65

Ordinary Repairs—Cayuga and Seneca Canal.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
W. H. H. Gere	Division engineer	....	$3,000 per yr.	$50 00	$0 84	$50 84

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Improving Limestone Creek Feeder at Fayetteville.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
Guy Moulton............	First ass't engineer...	10	$6 00	$60 00	$1 40	$61 40

Bulkhead—Oneida Feeder.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation	Salary.	Travel.	Total.
F. J. Wagner	Leveler.	11	$4 50	$49 50	$4 54	$54 04
Incidental expenses.						
Miscellaneous..						$1 10
Total						$55 14

Warner's Slide—Erie Canal.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	1st Asst. engineer....	4	$6 00	$24 00	....	$24 00
F. J. Wagner	Leveler	4	4 50	18 00	....	18 00
L. K. Devendorf	Rodman..............	2	3 50	7 00	....	7 00
Total...............	....	....	....	....	....	$49 00

STATEMENT SHOWING NAMES, RANK, ETC.—*(Continued)*.

Bulkhead at Fulton—Oswego Canal.

(Chapter 568, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First asst. engineer	14	$6 00	$84 00	$1 80	$85 [illegible]
F. J. Wagner	Leveler	3	4 50	13 50		13 50
L. K. Devendorf	Rodman	1	3 50	3 50		3 50
						$102 80
Incidental expenses.						
Postage						50
Total						$103 30

Rebuilding Lock No. 47—Black River Canal.

(Chapter 568, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
Reeves Smith	First asst. engineer	3	$6 00	$18 00		$18 00
Incidental expenses.						
Miscellaneous						$43 30
Total						$61 30

Rebuilding Lock No. 64—Black River Canal.

(Chapter 568, Laws of 1899.)

Incidental expenses.

Miscellaneous	$34 [illegible]

Extraordinary Repairs—Examination of Roads and Reservoirs in Adirondacks.

(Chapter 568, Laws of 1899.)

NAME.	Rank	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First asst. engineer	19	$6 00	$114 00	$25 7[illegible]	$139 7[illegible]

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Improvement of Public Highways.

(Chapter 115, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First asst engineer	16	$6 00	$96 00	$3 42	$101 42
Reeves Smith	First asst. engineer	43	6 00	258 00	5 55	263 55
S. J. Steward	Assistant engineer	19	5 00	95 00	....	95 00
Paul L. Schultze	Assistant engineer	73	5 00	365 00	62 99	427 99
Arthur O'Brien	Assistant engineer	15	5 00	75 00	....	75 00
E C. Clark	Leveler	14	4 50	63 00	3 45	66 45
Fred W. Sarr	Leveler	137	4 50	616 50	22 74	639 24
L. K. Devendorf	Rodman	90	3 50	315 00	1 90	316 90
George H. Thomas	Chainman	62	3 00	186 00	58	186 58
Henry S. Ball	Chainman	15	3 00	45 00	....	45 00
H. S. Van Valkenburgh	Chainman	4	2 50	10 00	....	10 00
John Schimmel	Chainman	55	2 50	137 50	....	137 50
Henry S. Ball	Chainman	79	2 50	197 50	....	197 50
H. K Burdick	Chainman	14	2 50	35 00	3 65	38 65
Eugene C. Olcott	Draughtsman	18	4 50	81 00	....	81 00
Howard U. Lyon	Laborer	....	....	....	2 20	2 20
M. T. Hourigan	Laborer	....	....	....	9 99	9 99
						$2,693 97

Incidental expenses

Labor	$716 85	
Livery	2 00	
Stationery	10 25	
Postage	3 00	
Miscellaneous	159 85	891 95
Total		$3,585 92

Lift Bridge at Whitesboro Street, Utica.

(Chapter 563, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Paul L. Schultze	Assistant engineer	97	$5 00	$485 00	$13 22	$498 22
John Schimmel	Chainman	11	2 50	27 50	....	27 50
						$525 72

Incidental expenses.

Miscellaneous	145 88
Total	$671 60

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Lift Bridge at Broad Street, Utica.

(Chapter 565, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First asst. engineer	3	$6 00	$18 00	....	$18 00
Paul L. Schultze	Assistant engineer	99	5 00	495 00	$40 78	535 78
L. K. Devendorf	Rodman	6	3 50	21 00	....	21 00
E. J. Berry	Chainman	3	4 50	13 50	....	13 50
John Schimmel	Chainman	11	2 50	27 50	....	27 50
						$615 78
Incidental expenses.						
Labor					$45 00	
Fuel and light					3 68	
Postage					3 82	
Office rent					19 00	
Telephone and telegraph					4 00	
Miscellaneous					127 89	
						203 39
Total						$818 17

Lift Bridge at Salina Street, Syracuse.

(Chapter 571, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	...	$3,000 per yr.	$200 00	....	$200 00
Reeves Smith	First asst. engineer	16	$6 00	96 00	....	96 00
S. J. Steward	Assistant engineer	2	5 00	10 00	....	10 00
F. W. Sarr	Leveler	11	4 50	49 50	....	49 50
Fred J. Wagner	Rodman	130	4 50	585 00	$8 96	593 96
E. J. Berry	Chainman	19	4 50	85 50	....	85 50
						$1,014 96
Incidental expenses.						
Postage					$0 67	
Miscellaneous					35 00	
						35 67
Total						$1,070 63

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Completing Approaches to Bridge at Inlet—Otisco Lake.

(Chapter 615, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First asst. engineer	3	$6 00	$18 00	$5 84	$23 84
Fred J. Wagner	Leveler	28	4 50	126 00	21 17	147 17
						$171 01
Incidental expenses.						
Labor					$10 00	
Livery					28 00	
Miscellaneous					11 73	
						49 73
Total						$220 74

Repairing and Protecting Banks—Oriskany Creek Feeder.

(Chapter 620, Laws of 1898.).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	....	$3,000 pr yr.	$16 67	$3 36	$20 03
Guy Moulton	First asst. engineer	5	$6 00	30 00	7 64	37 64
Fred J. Wagner	Rodman	10	4 50	45 00	24 44	69 44
						$127 11
Incidental expenses.						
Livery					$0 75	
Postage					1 44	
Miscellaneous					70	
						2 89
Total						$130 00

Vertical Wall—Oneida Feeder.

(Chapter 633, Laws of 1898).

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
W. H. H. Gere	Division engineer	...	$3,000 pr. yr.	$25 00	....	$25 00
Guy Moulton	First asst. engineer	5	$6 00	30 00	....	30 00
F. J. Wagner	Leveler	74	4 50	333 00	$11 26	344 26
						$399 26
Incidental expenses.						
Labor					$6 75	
Postage					1 00	
Telephone and telegraph					60	
Miscellaneous					3 10	
						11 45
Total						$410 71

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Peterboro Street Bridge—Canastota.

(Chapter 626, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Guy Moulton	First asst. engineer	1	$6 00	$6 00	$1 34	$7 34
S. J. Steward	Assistant engineer	2	5 00	10 00	....	10 00
						$17 34
Incidental expenses.						
Miscellaneous						475 92
Total						$493 26

Catherine Street Bridge—Syracuse.

(Chapter 424, Laws of 1898.)

Incidental expenses.

Miscellaneous	$481 84

Schuyler Street Bridge—Utica.

(Chapter 427, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First asst. engineer	4	$6 00	$24 00	$7 26	$31 26
						$31 26
Incidental expenses.						
Miscellaneous						86 17
Total						$117 43

Washington Street Bridge—Utica.

(Chapter 397, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Eugene C. Olcott	Draughtsman	1	$4 50	$4 50	....	$4 50
Incidental expenses.						
Miscellaneous						264 63
Total						$269 13

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Removal of Bars—Cayuga and Seneca Canal, at Cayuga.

(Chapter 606, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
David E. Whitford	Assistant engineer	13	$5 00	$65 00	$73 56	$138 56
E. J. Berry	Leveler	10	4 50	45 00	......	45 00
Eugene C. Olcott	Draughtsman	1	4 50	4 50	.....	4 50
George H. Thomas	Chainman	10	8 00	80 00	......	80 00
						$218 06
Incidental expenses.						
Labor					$20 00	
Miscellaneous					46 65	
						66 65
Total						$284 71

Ditch between Seneca Falls and Waterloo.

(Chapter 786, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First ass't engineer	6	$6 00	$36 00	$5 99	$41 99
E. C. Clark	Leveler	26	4 50	117	10 78	127 78
						$169 77
Incidental expenses.						
Miscellaneous						60
Total						$170 37

Light House at Cayuga.

(Chapter 425, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
C. K. Munroe	Chainman	5	$5 00	$25 00	....	$25 00

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Repairing Bridge at Liberty Street—Penn Yan.

(Chapter 193, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First asst. engineer	2	$6 00	$12 00	$4 48	$16 48
			Incidental expenses.			
Miscellaneous						25 18
Total						$41 66

Surveys on Account Attorney General.

(Chapter 569 Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Reeves Smith	First asst. engineer	17	$6 00	$102 00	$13 38	$115 38
Guy Moulton	First asst. engineer	46	6 00	276 00	335 22	611 22
D. E. Whitford	Assistant engineer	3	5 00	15 00	....	15 00
E. C. Clark	Leveler	54	4 50	243 00	156 37	399 37
L. K. Devendorf	Rodman	3	3 50	10 50	....	10 50
E. J. Berry	Chainman	4	4 50	18 00	1 45	19 45
D. E Whitford	Chainman	11	5 00	55 00	2 84	57 84
H. K. Burdick	Chainman	54	2 50	135 00	....	135 00
						$1,363 76
			Incidental expenses.			
Labor					$437 00	
Livery					108 00	
Postage					20	
Telephone and telegraph					1 17	
Miscellaneous					64 09	610 46
Total						$1,974 22

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Seneca Lake Survey.

(Chapter 501, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
David E. Whitford	Assistant engineer	76	$5 00	$380 00	$523 50	$903 50
Noble E. Whitford	Assistant engineer	29	5 00	145 00	....	145 00
E. J. Berry	Leveler	74	4 50	333 00	....	333 00
George H. Thomas	Chainman	74	3 00	222 00	....	222 00
						$1,603 50

Incidental expenses.

Labor	$158 00	
Livery	37 00	
Stationery	3 00	
Postage	1 20	
Telephone and Telegraph	83	
Miscellaneous	14 09	
		214 12
Total		$1,817 62

Cornell Land Survey.

(Chapter 122, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
Arthur O'Brien	Assistant engineer	63	$5 00	$315 00	$362 14	$677 14
Lewis B. Jones	Leveler	30	4 50	135 00	22 77	157 77
H. S. Meekham	Expert surveyor	59	5 00	295 00	....	295 00
Leroy Lewis, Jr	Chainman	62	3 00	186 00	....	186 00
W. P. Judson	Deputy State engineer	....	....	....	20 13	20 13
I. J. Morris	Confidential clerk	...	....	....	30 48	30 48
						$1,366 52

Incidental expenses.

Labor	$598 24	
Livery	57 50	
Postage	1 00	
Office rent	10 00	
Telephone and telegraph	82	
Miscellaneous	20 40	
		685 96
Total		$2,052 48

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Summary.

ITEMS.	AUTHORIZED BY Chap.	AUTHORIZED BY Laws.	Amounts.	Totals.
ORDINARY REPAIRS.				
Erie canal	435 550 569 571	1897 1898 1899 1899	$18,266 68	
Oswego canal	550	1898	726 75	
Black River canal	505	1898	825 65	
Cayuga and Seneca canal	569	1899	50 84	$19,869 92
EXTRAORDINARY REPAIRS				
Erie Canal.				
Improving Limestone Creek feeder—Fayetteville	208	1899	$61 40	
Bulkhead—Oneida feeder	208	1899	55 14	
Warner's slide	208	1899	49 00	165 54
Oswego Canal.				
Bulkhead at Fulton	208	1899	102 50	102 50
Black River Canal.				
Rebuilding lock No. 47	208	1899	61 30	
Rebuilding lock No. 64	208	1899	84 21	
Examination of roads and reservoirs in Adirondacks	208	1899	139 71	235 22
Improvement of public highways	115	1898	....	3,585 95
SPECIAL APPROPRIATIONS.				
Erie Canal.				
Lift bridge at Whitesboro street—Utica	563	1897	$671 60	
Lift bridge at Broad street—Utica	565	1897	818 17	
Lift bridge at Salina street—Syracuse	571	1897	1,070 63	
Completing approaches to bridge—Otisco Lake	615	1898	220 74	
Repairing and protecting banks—Oriskany Creek feeder	620	1898	130 00	
Vertical wall—Oneida feeder	633	1898	410 71	
Peterboro street bridge—Canastota	6.6	1898	493 26	
Catherine street bridge—Syracuse	424	1898	481 84	
Schuyler street bridge—Utica	427	1898	117 43	
Washington street bridge—Utica	397	1898	269 13	4,683 51
Cayuga and Seneca Canal.				
Removal of bars—Cayuga and Seneca Canal—Cayuga	606	1898	$284 71	
Ditch between Seneca Falls and Waterloo	786	1897	170 37	
Light house at Cayuga	425	1898	25 00	
Repairing Liberty street bridge—Penn Yan	190	1898	41 66	521 74
Special Surveys.				
Surveys on account of Attorney-General	569	1899	$1,974 22	
Seneca Lake survey	501	1899	1,817 62	
Cornell land survey	122	1898	2,052 48	5,844 32
Total abstracts rendered during fiscal year	....	....	....	$35,008 67

TABLE No. 2.

Statement of Contracts in Force September 30, 1899.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Act.		Engineer's estimate.	Engineer's estimate at contract prices.[§]	Payments to September 30, 1899.
			Chap.	Laws.			
G. D. Grannis	Aug. 2, 1899	Dredging Cayuga and Seneca canal at Cayuga	606	1898	$8,800 00	$7,025 00	$892 50
Walter Bradley & Co.	July 18, 1899	Constructing vertical walls on tow-path, building cross-walks, pointing old masonry and building gas pipe railings at First and Oneida street bridge at Fulton, N. Y.	113 477	1897 1899	2,486 75	2,179 00	Nothing.
Walter Bradley & Co.	Sept. 18, 1899	Constructing bulkhead and gates at head of Mill canal at Fulton, N. Y.	208	1899	2,645 00	2,611 00	Nothing.
Walter Bradley & Co.	Sept. 11, 1899	Rebuilding lock No. 47, Black River canal	208	1899	19,945 00	15,776 30	Nothing.
Walter Bradley & Co.	Sept. 11, 1899	Rebuilding lock No. 64, Black River canal	208	1899	19,945 00	15,776 30	Nothing.
Gillette, Hay & Gillette	May 29, 1899	Completing approaches to bridge over inlet to Otisco Lake	615	1898	8,847 50	6,943 00	$1,666 00
W. J. Marson	May 29, 1899	Repairing bridge at foot of Liberty street, Penn Yan, N. Y.	190	1898	1,308 50	1,182 00	Nothing.
Havana Bridge Works	May 31, 1899	Lift bridge at Peterboro street, Canastota, N. Y.	626	1898	15,318 75	15,639 10	Nothing.
Havana Bridge Works	April 21, 1899	Lift bridge at Schuyler street, Utica, N. Y.	427	1898	10,000 00	10,480 00	Nothing.

[§] Estimate of cost at "Contract prices" is the footing of bidding sheet at the letting.

TABLE No. 3.

Statement of Contracts Completed and Settled during the Fiscal Year.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	ACT.		Appropriation.	Engineer's estimate.	Final account.
			Chap.	Laws.			
John Kelley	Mch. 23, 1899	Vertical retaining walls on Oneida Feeder	633	1898	$8,000 00	$7,060 00	$1,641 96
Groton Bridge & Manufacturing Co.	Feb. 24, 1898	Lift bridge at Salina street, Syracuse, N. Y.	571	1897	*36,000 00	35,425 00	30,694 65
Groton Bridge & Manufacturing Co.	Feb. 24, 1898	Lift bridge at Whitesboro street, Utica, N. Y.	563	1897	§20,000 00	25,567 00	20,676 57
Havana Bridge Works	Feb. 28, 1897	Lift bridge at Broad street, Utica, N. Y.	565	1897	‡25,000 00	22,816 50	17,022 23
John R. Briggs	May 25, 1899	Repairing and protecting banks of Oriskany Creek Feeder	620	1898	1,500 00	1,200 00	879 56
Havana Bridge Works	Nov. 5, 1898	Constructing a light house at Cayuga, N. Y.	425	1898	400 00	375 00	346 00

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* The city of Syracuse paid $18,000 00 of this amount. § The city of Utica paid $10,000 00 of this amount, and the Superintendent of Public Works $676.57. ‡ The city of Utica paid $5,000.00 of this amount.

TABLE No. 4.

Statement of Contracts Completed and Settled during the Fiscal Year.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Engineer's estimate.	Amount of final account.
		Improvement of the Erie Canal.		
John Dunfee & Co.	Nov. 14, 1896	Contract No. 3	$142,798 00	$234,339 27
John Dunfee & Co.	Nov. 14, 1896	Contract No. 5	150,614 50	212,403 76
O'Brien & Hoolihan	Mch. 19, 1897	Contract No. 18	96,373 00	208,336 76
Rochester Bridge and Iron Works	Nov. 13, 1897	Contract No. 47	12,425 00	15,735 28
		Improvement of the Oswego Canal.		
Willard Johnson	Aug. 30, 1897	Contract No. 37	13,836 00	12,053 16

TABLE No. 5.

Statement of Contracts Suspended May 14, 1898.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payment to September 30, 1899.	Total amount of work done.
		Improvement of Erie Canal.				
McDonald & Sayre	Nov. 17, 1896	Contract No. 2	$239,772 00	$148,948 80	$269,469 00	*$301,155 15
John Dunfee & Company	Nov. 14, 1896	Contract No. 4	155,409 00	154,471 00	546,165 00	*624,062 66
O'Brien & Hoolihan	Mch. 19, 1897	Contract No. 19	106,322 50	105,083 50	182,367 00	*204,472 80
Warren-Scharf Asphalt Co	Aug. 17, 1897	Contract No. 20	246,653 00	242,757 55	68,940 00	*77,675 01
Warren-Scharf Asphalt Co	Aug. 17, 1897	Contract No. 21	218,247 00	212,945 45	53,496 00	*61,167 33
National Contracting Co	Aug. 6, 1897	Coutract No. 22	247,465 00	232,307 50	170,289 00	*191,485 01
E. H. Gaynor	Aug. 23, 1897	Contract No. 23	165,897 00	147,582 00	134,649 00	*150,041 54
National Contracting Co	Aug. 6, 1897	Contract No. 24	142,051 00	136,720 00	101,106 00	*111,289 48
National Contracting Co	Aug. 6, 1897	Contract No. 25	140,680 00	127,750 00	98,946 00	*109,132 26
John Dunfee & Company	Aug. 6, 1897	Contract No. 26	145,452 00	136,600 00	240,840 00	*267,114 12
Willowby B. Priddy	Aug. 18, 1897	Contract No. 27	125,869 00	115,713 00	200,466 00	*225,328 22
Andrew Onderdonk	Aug. 19, 1897	Contract No. 28	172,430 00	167,216 00	116,708 00	*128,558 84

*Indicates amount of final account.

.TABLE No. 5.

Statement of Contracts Suspended May 14, 1898.

NAME OF CONTRACTOR.	Date of contract.	Character of work.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Amount of final account.
		Improvement of Oswego Canal.			
Dodge & MacGregor	Dec. 8, 1896	Contract No. 6	$14,497 00	$12,206 00	$14,685 63
John Kelley & Company	Nov. 16, 1896	Contract No. 7	12,618 00	10,695 00	5,615 32
John Kelley & Company	Nov. 16, 1896	Contract No. 8	15,333 00	13,425 50	10,059 33
John Kelley & Company	Nov. 16, 1896	Contract No. 9	20,049 00	17,801 00	15,592 54
Hughes Brothers & Bangs	Nov. 20, 1896	Contract No. 10	48,058 00	51,370 50	48,884 71
Kirk, Driscoll & Company	Dec. 20, 1897	Contract No. 34	136,885 00	126,655 00	79,510 73
Walter Bradley	Dec. 27, 1897	Contract No. 46	16,860 00	12,636 50	412 52

TABLE No. 6.

Statement of the Improvement of Public Highways.

(Chapter 115, Laws of 1898, and Chapter 569, Laws of 1899.)

CONTRACTOR.	Date of contract.	Character of work.	Engineer's preliminary estimate.	Engineer's estimate at contract prices.	Payment to September 30, 1899.
J. J. Dwyer & Co.	Oct. 4, 1898	Improving Deerfield road No. 3	$15,968 00	$13,806 85	$10,251 22
Clark & Hibbard	July 6, 1899	Improving Cortland street road No. 8	4,831 34	4,375 00	1,640 63
Clark & Hibbard	Sept. 21, 1899	Supplementary contract, road No. 8	7,525 00	6,828 00	....
Fred O. Sterling	July 1, 1899	Improving James street road No. 9	3,463 80	3,450 00	2,870 25
Fred O. Sterling	Sept. 21, 1899	Supplementary contract, road No. 9	3,625 00	3,265 00	....

TABLE No. 7.

Water Record of Cayuga and Cross Lakes and Seneca River—Continued.

(See State Engineer's Report for 1898 for previous records.)

LOCATION.	1898.		1899.		1899.		Remarks.
	December 5th and 6th.		March 7th and 8th.		August 7th and 8th.		
	WATER.		WATER.		WATER.		
	Surface.	Depth.	Surface.	Depth.	Surface.	Depth.	
Cayuga Lake	—8.85	10.23	—8.86	10.22	—9.56	9.6	Depth on lower mitre sill of lock.
Mud lock	—9.05	10.16	—9.22	10.00	—9.58	9.7	Depth on lower mitre sill of lock.
Canandaigua River, south of canal	—11.01	6.1	—9.04	8.05	—12.73	4.6	Depth of river.
Seneca River aqueduct	—11.35	7.1	—10.97	7.43	—12.55	5.5	Depth on aqueduct foundation.
Canandaigua River, north of canal	—11.47	6.2	—9.50	7.15	—12.96	3.7	Depth of river.
West Shore railroad crossing	—11.86	3.7	—11.03	4.54	—13.77	0.9	Depth on natural bed.
N. Y. C. & H. R. R. crossing	—12.21	5.2	—11.35	5.06	—13.81	2.6	Depth on bridge foundation.
Mosquito Point	—14.13	1.9	—13.02	3.0	—16.40	Bed dry	Depth on natural bed.
	....	5.2	....	4.2	....	6.0	Depth in channel dredged.
Cross Lake	—15.48	20.9	—14.15	22.2	—17.62	17.5	Depth at Iron bridge.

REPORT

OF THE

DIVISION ENGINEER

OF THE

WESTERN DIVISION

For the Fiscal Year Ending September 30, 1899.

Western Division.

ROCHESTER, N. Y., *October* 1, 1899.

HON. EDWARD A. BOND, *State Engineer and Surveyor, Albany, N. Y.:*

Dear Sir.—In accordance with your instructions, I have the honor herewith to submit a report of the work performed by the Engineer's Department on the Western division, for the fiscal year ending September 30, 1899, which I have divided into two sections, namely, Canal and Special Appropriation Work, and Road Improvement, under chapter 115, Laws of 1898.

CANALS AND GENERAL APPROPRIATIONS.

This division comprises the following canals and slips:

	Miles.
Erie canal, from the east line of Wayne county to the westerly line of Main street, in the city of Buffalo..	147.88
Clark and Skinner canal, Ohio basin slip, Commercial slip and slips 1, 2 and 3 in the city of Buffalo, aggregate length	1.60
Chemung canal, from the northerly line of Ayres street, Montour Falls, to Seneca lake (Seneca level) unnavigable	2.53
Total	152.01

UNNAVIGABLE FEEDERS.

	Miles.
Tonawanda and Oak Orchard, from upper dam Tonawanda creek to Erie canal at Medina.............	11.55
Genesee Valley canal, from Cuba reservoir to Lock No. 87, Rockville.................................	7.65
Genesee Valley canal, from Scottsville to Rochester rapids dam	11.00
Genesee River feeder, in the city of Rochester (partially navigable)	2.25
Total	32.45

Cuba and Rockville reservoirs are the only storage reservoirs upon this division.

The Cuba reservoir is formed by an earthern dam faced with rip-rap which is sixty-five (65) feet high (where it crosses the stream), and 2,200 feet long. A spillway crossing a creek about two miles distant, has a waste weir which provides relief when the reservoir is full. About 1890, owing to fears of a break by the inhabitants of the valley below, this spillway was lowered five and one-half feet, the original capacity of the reservoir was 560,000,000 cubic feet, but no data is at hand of the present capacity. The water taken from Cuba reservoir flows through the old Genesee Valley canal and Black creek, into the Genesee river, and is supplemented by the overflow from the Rockville reservoir, which at present does not store a large volume of water, as the spillway has been considerably lowered.

The details of the various structures have been given with such fullness in recent annual reports of my predecessors, that tables of these are here omitted, the only changes being such as are specially designated in the following detailed statement of each piece of work completed, or in process during the present year:

CAYUGA CREEK IMPROVEMENT, TOWN OF WHEATFIELD, NIAGARA COUNTY.

Chapter 559, Laws of 1897.

Contract dated, October 9, 1897. Contract to be completed, January 1, 1898. Contract completed, October 29, 1898. Contractor, W. A. Gillette.

Appropriation	$5,000 00
Engineer's estimate	4,380 00
Contract price	2,870 00
Final estimate	3,796 76

This work was done under plans approved by the State Engineer, August 10, 1897, and contemplated the cleaning out and grading of the west branch of Cayuga creek, southerly from the junction of the two branches of this creek.

SOUTH FITZHUGH STREET BRIDGE, ROCHESTER.

Chapter 32, Laws of 1897; chapter 606, Laws of 1898; chapter 477, Laws of 1898.

Contract dated, July 8, 1898. Contract to be completed, April 1, 1899. Contractor, Rochester Bridge and Iron Works.

Total appropriation	$27,000 00
Engineer's estimate	25,969 75
Contract price	23,931 50
Final estimate	24,475 73

The plans were adopted by the Canal Board, December 2, 1897, contemplating a lift bridge with lattice trusses, 102 feet 9 inches center to center of end posts; 36 feet center to center of trusses, and sidewalks each 10 feet wide, carried on brackets extending out from the girders, the water cylinders and counterweight boxes being in concrete. Metal lined pits below the grade of the street at each end; the driveway is floored with oak and the walks with pine.

The original appropriation of $20,000 under chapter 32, Laws of 1897, proving insufficient, a further appropriation of $7,000 was made available by chapter 606, Laws of 1898, and a contract entered into with the Rochester Bridge and Iron Works, dated July 8, 1898. Work was begun November 23, 1898, and the structure was entirely completed May 10, 1899. A new water main was laid by the city of Rochester to supply the power to operate this bridge.

When the bridge was first put in operation, some difficulty was experienced through the oakum being drawn out of the joints and clogging the operating valve, but with this exception the bridge has been operated successfully during the entire season and given universal satisfaction. This type of bridge seems to be well adapted to its uses.

SOUTH CLINTON STREET BRIDGE, ROCHESTER.

Chapter 339, Laws of 1897; chapter 477, Laws of 1899.

Contract dated, March 12, 1898. Contract to be completed, August 1, 1898. Contractor, Rochester Bridge and Iron Works.

Appropriation	$20,000 00
Engineer's estimate	19,729 50
Contract price	15,862 00
Final estimate	16,850 22

The act called for a suitable bridge, with a roadway of 36 feet in width, and two sidewalks each 10 feet in width. The plans adopted by the Canal Board, December 30, 1897, called for a plate girder bridge, 93 feet 2 inches out to out, and 38 feet centre to center of girders, the floor of the roadway being of brick laid on concrete and supported by buckle plates, and the walks of stone flag carried on brackets extending out from the girders, as well as the entire repaving of the south, and a portion of the north approaches, both walks and roadways, portions of the walks being carried on steel columns.

Work was commenced October 31, 1898, and completed May 31, 1899.

A concrete walk (Ransome construction) was substituted for the stone flagging called for in the original plans, after due approval by the proper State officials, thus reducing the dead load due to the walks, by 50 per cent. and making a handsomer and more durable walk.

MONROE AVENUE BRIDGE, ROCHESTER.

Chapter 207, Laws of 1897; chapter 607, Laws of 1898; chapter 477, Laws of 1899.

Contract dated, March 10, 1898. Contract to be completed, July 1, 1898. Contractor, B. P. Smith.

Total Appropriation	$36,000 00
Engineer's estimate	29,701 65
Contract price	33,965 00
Final estimate	33,303 20

The original act called for the construction of a substructure for a bridge consisting of two 25 foot roadways, and two sidewalks eight feet wide, and for one-half of the superstructure, placed upon one side of the street, with ultimate provision for an additional roadway and walk.

Plans upon this basis were prepared, passed by the Canal Board, February 2, 1898, and contract entered into with B. P. Smith, dated March 10, 1898, for the sum of $25,494.00.

It having become apparent that a material saving in cost would be made through the completion of the entire structure at one time and by one contractor, a further appropriation of $4,000 was obtained under chapter 607, Laws of 1898, and a supplemental contract was entered into for this extra work on April 29, 1898, for the sum of $8,471, making the total contract, $33,965.

This structure consists of three girders of the plate and lattice type. The span in the clear along the center line of the bridge is 118 feet; skew, 44 degrees, 40 minutes, and the length of trusses out to out is 125 feet. The two roadways are paved with asphalt laid upon a concrete foundation, with buckle plate floors. The walks are carried upon brackets hung from the outer girders and are of concrete (Ransome construction) with a crushed granite surface.

A double track electric street railway crosses this bridge, the tracks being placed one on each roadway, adjoining the outside trusses. The masonry above the water surface is first class rock face ashler, and below the water surface second-class masonry. Union Spring limestone was used.

This structure represents a good type of fixed bridge, and is adapted to important crossings where the traffic is heavy.

REBUILDING CULVERTS NOS. 42, 43, 45 and 56.

Chapter 566, Laws of 1897.

Contract dated, January 10, 1898. Contract to be completed, April 15, 1898. Contractor, John Calnan.

Appropriation—Extraordinary repair fund.

Engineer's estimate	$9,127 00
Contract price	8,860 15
Final estimate	10,669 18

The plans for this work were adopted by the Canal Board, October 28, 1897.

CULVERT NO. 42.

The work upon this culvert was started February 12, 1898, and completed April 30, 1898, consisting of the rebuilding of the wings and parapets of both ends of the culvert, and 11 feet of the arch and bench walls, with a masonry foundation at the south end.

CULVERT NO. 43.

The work upon this culvert was begun February 12, 1898, and completed April 30, 1898, and consisted in lengthening the towpath end of the arch four feet, and rebuilding 13 feet of the old arch, and bench walls, together with the parapet and wings.

CULVERT NO. 45.

Work was begun February 12, 1898, and completed April 30, 1898. The work done on this culvert consisted in rebuilding parapets and wing walls on towpath and berme sides, lengthening arch and bench walls on berme side two feet and rebuilding arch and bench walls on berme side eight feet. On towpath side 8.5 feet of the arch and bench walls were rebuilt, and lengthened three feet.

CULVERT NO. 56.

Work was begun December 27, 1898, and finished May 27, 1899. The plans called for the replacing of a composite culvert of two 4 feet by 3 feet openings by two rows of 48-inch cast iron pipe, laid on a timber foundation. When work was started a rock foundation was found under the old culvert, and the timber foundation was omitted from the new work. The concrete placed around the pipe followed the old rock excavation slopes, and overlapped top of rock about one foot, and was carried up and over top of pipe with a thickness of one foot, the concrete being eight feet wide over top of pipes, with sloping sides to the surface of the rock. The pipes are laid six feet center to center, and are 130 feet long.

HAMILTON STREET BRIDGE, BUFFALO.

Chapter 568, Laws of 1897.

Contract dated, February 24, 1898. Contract to be completed, May 1, 1898. Contractor, Buffalo Dredging Co.

Appropriation	$10,000 00
Engineer's estimate	8,055 00
Contract price	7,497 06
Final estimate	9,285 17

The plans for this bridge were passed by the Canal Board December 2, 1897, and contemplated the removal of the old cooper arch bridge; the taking down of the old lattice truss at Monroe avenue, Rochester; the remodeling of same and putting in place at this site, together with the rebuilding of an entirely new berme abutment, and the rebuilding of the upper portion of the towpath abutment, but as work progressed it was found that the foundation of the towpath abutment was defective, which necessitated the entire rebuilding of this abutment, with a consequent increase in the cost of the work.

The old superstructure was 118 feet over all, with a skew of about 45 degrees, which was remodeled into a lattice span 118 feet over all, 21 feet center to center of trusses, and two walks each seven feet wide, bracketed from the trusses. The southerly retaining wall of the west abutment should be provided with an iron handrailing, but the appropriation would not permit of this addition.

EXCHANGE STREET BRIDGE, ROCHESTER.

Chapter 514, Laws of 1895; chapter 572, Laws of 1897; chapter 791, Laws of 1897; chapter 506, Laws of 1898.

Contract dated, November 29, 1897. Contract to be completed, May 1, 1898. Contractors, Chambers & Casey.

Total appropriations	$46,545 74
Engineer's estimate	41,337 00
Contract price	35,196 25
Final estimate	46,544 99

Plans complying with the law were passed by the Canal Board August 28, 1896, calling for lift bridge consisting of two trusses 97 feet 9 inches center to center of end posts, spaced 50 feet center to center of trusses, with two sidewalks 10 feet wide outside of the trusses, with counterweight pits at either end below the street level, connected by riveted steel tunnel (the brick tunnel of the original plans having been discarded), containing the operating machinery and cables, consisting of a water cylinder and equalizing device. This structure is so counterweighted as to be normally lifted, and is lowered by means of the water cylinders.

As the construction progressed, numerous changes in the plans were found advisable, and were made. The design was novel, and being the largest lift bridge in the State, it was but natural that defects would appear which were remedied as discovered.

Great difficulty was encountered in building the pits, due to the seamy nature of the rock, which necessitated very extensive and unexpected work, to keep the water pressure from buckling the metal lining upon the letting of water in the canal.

The bridge was first operated April 30, 1898, but after several weeks use, defects in the machinery details becoming apparent, alterations and improvements were made and the bridge again opened June 25, 1898, with the result that the bridge has been in constant and successful operation since.

The final estimate not having been made, and the paint (although of good brand) which had originally been applied having peeled off, the contractors at my request, scraped the metal and applied two new coats of paint before acceptance.

NEWTOWN CREEK IMPROVEMENT, HORSEHEADS, N. Y.

Chapter 607, Laws of 1898.

Contract dated, August 3, 1899. Contract to be completed, November 1, 1899. Contractors, Gillette, Hay & Gillette.

Appropriation	$5,000 00
Engineer's estimate	4,330 00
Contract price by bidding sheet	3,945 00
Estimate of work done to September 30, 1899	3,020 00

The work done under this act is a continuation of work previously done under chapter 949, Laws of 1896, and chapter 791, Laws of 1897, and consists in excavating the channel of Newtown creek, from its confluence with Beaver brook northerly for a distance of about 15,000 feet, building berme banks or dikes with the excavated material, and the protection of the banks in various places, subject to excessive erosion, with piles reinforced by planking.

The work done under this act consists primarily in constructing a channel 100 feet wide upon the bottom, with banks five feet high, between Stas. 79 and 44, leaving 4,400 feet remaining to be improved, to carry out the plans as originally contemplated.

SOUTH AVENUE BRIDGE, BRIGHTON.

Chapter 618, Laws of 1898.

Contract dated, May 16, 1899. Contract to be completed, April 1, 1900. Contractor, Havana Bridge Works.

Appropriation	$25,000 00
Engineer's estimate	24,059 50
Contract price	22,498 00

The plans for a bridge to replace the present fixed structure (which is a cast iron whipple arch with very steep approaches), were approved by the Canal Board October 20, 1898, and contemplated a lift bridge with two lattice trusses 91 feet 6 inches center to center of end posts, 22 feet center to center of trusses, and sidewalks each six feet eight inches wide, supported upon the floor beams which extend beyond the trusses. Two overhead walks were provided upon the original plans, for use when the bridge is raised, but lack of funds made it desirable to omit these at the present time; the structure is to be built so that these may be readily added in the future should they become necessary. The counterweights and operating cylinders are housed in the end towers above the ground surface.

Power to operate this bridge will be developed at lock 64, about 1,200 feet westerly of the site of the bridge, where will be located an 18-inch turbine, a seven-inch by eight-inch triplex pump, and a cylindrical accumulator tank 68 inches in diameter and 21 feet long, all suitably housed. A 30-inch cast-iron penstock, and a similar tail race are provided for the turbine, the water under pressure being carried to the operating cylinders through a six-inch cast-iron main, laid along the berme bank.

This bridge will be built during the winter of 1899 and 1900.

NEW HOME BRIDGE OVER TONAWANDA CREEK.

Chapter 630, Laws of 1898.

Contract dated, May 29, 1899. Contract to be completed, February 1, 1900. Contractors, Hilton Bridge Construction Co.

Appropriation	$15,000 00
Engineer's estimate	11,610 00
Contract price	10,641 50

The plans for this bridge were approved by the Canal Board October 20, 1898, and contemplate the replacing of the present two span wooden structure with a single span lattice truss through bridge, 200 feet end to end, and 18 feet center to center of trusses, and the building of new masonry abutments upon pile and grillage foundation. The contractors expect to begin taking down the old structure and rebuilding the berme abutment before the close of navigation this season, and complete the balance during the closed season.

MAIN STREET BRIDGE, PITTSFORD.

Chapter 504, Laws of 1898.

Contract dated, April 21, 1899. Contract to be completed, April 1, 1900. Contractor, B. P. Smith.

Appropriation	$19,000 00
Engineer's estimate	17,042 50
Contract price	16,541 00

The plans adopted by the Canal Board February 9, 1899, contemplate the replacing of the present structure (which is a cast-iron whipple arch, 77 feet, 9 inches clear span, carrying a roadway 19 feet wide, and two sidewalks each 5.5 feet wide, bracketed outside of the trusses), with a bridge consisting of three plate girders of 84 feet clear span, spaced 25 feet center to center, thus providing two roadways, and with two walks eight feet in width, carried on brackets attached to the outer girders. A plank flooring is carried upon metal floor joists. This structure will be erected during the winter of 1899 and 1900, as well as a new masonry substructure.

ERIE STREET BRIDGE, BUFFALO, N. Y.

Chapter 611, Laws of 1898.

Contract dated, March 23, 1899. Contract to be completed, October 1, 1899. Contractors, Buffalo Bridge and Iron Works.

Appropriation	$27,000 00
Engineer's estimate	22,893 50
Contract price	18,723 00

The plans for this bridge were approved by the Canal Board October 20, 1898, and contemplate a fixed bridge with five plate girders 94 feet, six inches long out to out. The three roadway girders are spaced 30 feet center to center, and the center of outer or sidewalk girders 19 feet, three inches outside of center of roadway girders, making the total width of bridge center to center of outside girders 98 feet, 6 inches, the clear width of the roadways being 27 feet, 4 inches, and of the walks 17 feet, 8 inches. The roadways are to be paved with brick upon a concrete foundation, carried upon a buckle plate floor. The original plans contemplated plank walks, which have since been changed and concrete walks (Ransome construction) will be substituted. No material has been delivered up to October 1, and the contractor will be unable to complete the work within the contract time.

This bridge fell into the canal on July 10, 1897, during the prosecution of work on Contract No. 1 during the canal improvement, and new masonry substructure was built at that time.

DELAWARE STREET CULVERT, TONAWANDA, N. Y.

Chapter 632, Laws of 1898.

Contract dated April 21, 1899. Contract to be completed September 1, 1899. Contractors, Gillette, Hay & Gillette.

Appropriation	$6,000 00
Engineer's estimate	5,267 00
Contract price	4,708 75
Estimated to date	2,993 00

The original plans approved by the Canal Board contemplated a stone arch of 30 feet span, carrying a roadway 40 feet in width, with two walks 7 feet wide, all paved with brick, the foundation to be of timber upon piles.

The foundation proved to be a stiff, red clay, and a concrete foundation was substituted as a saving in cost.

A double-track trolley line crosses this bridge; Delaware street being paved, is the main highway out of Buffalo to the north, and has a very large traffic. Although this structure is not completed on time, it will be finished before winter sets in.

ERIE BASIN IMPROVEMENT, BUFFALO, N. Y.

Chapter 635, Laws of 1898.

Contract dated November 10, 1898. Contract to be completed August 1, 1899. Contractor, Jas. B. Donnelly.

Appropriation	$30,000 00
Engineer's estimate	25,520 00
Contract price	23,988 00
Amount of work done October 1, 1899	1,554 00

This act contemplates the providing of a channel 20 feet deep over a portion of the Erie basin at Buffalo.

Plans for this work were passed by the Canal Board July 28, 1899, but it was afterwards found that the plans adopted were incomplete in several particulars and did not entirely carry out the provisions of the act, for which reasons new plans were prepared and approved by the Canal Board at a meeting held July 20, 1899.

Work of excavation was begun July 17th, and the earth excavation promptly completed, but, owing to delay (due to various causes) in providing a plant for the rock excavation, but little work of this class has been done up to the present time. A new plant is now in operation and the work should progress in a satisfactory manner.

WATKINS HARBOR IMPROVEMENT.

Chapter 697, Laws of 1899.

Appropriation	$20,000 00
Engineer's estimate	14,089 53

Now being advertised. This work contemplates the rebuilding and renewing of the present outer breakwater, protecting and forming the harbor at Watkins, at the southerly end of Seneca lake, and at the entrance of the Chemung canal, together with the creating of a depth of eight feet of water below low water mark over a considerable portion of the harbor, with channels of the same depth to the lake, as well as to the adjacent slips.

TONAWANDA INDIAN RESERVATION. IMPROVEMENT OF HIGHWAY FROM JUDGE ROAD TO THE OAK ORCHARD FEEDER AT THE GUARD GATES.

Chapter 606, Laws of 1898; chapter 210, Laws of 1899.

At a meeting of the Canal Board held October 20, 1898, $250 was set aside for engineering (being a balance available from chapter 790, Laws of 1897) to carry out the provisions of chapter 606, Laws of 1898.

In the fall of 1898 a survey of this road, which is nothing more than a trail across the country, was made. The appropriation was insufficient, and chapter 210, Laws of 1899, provided an additional appropriation of $2,500.

For economic reasons it was found desirable to build a straight road between the two termini, which not only presented better natural features, but shortened the distance by nearly a mile.

The question of right of way for the new location was submitted to representatives of the Council of Chiefs, who concurred in the change and agreed to provide the right of way. The plans were then prepared upon this basis and releases presented at a meeting of the Council of Chiefs held September 28, 1899, at their council house, but in the interim some of the owners had changed their views and were unwilling to accept the terms previously agreed upon. The work is being delayed pending the securing of the necessary right of way.

FERRY STREET BRIDGE OVER BLACK ROCK HARBOR, BUFFALO, N. Y.

Chapter 618, Laws of 1899.

Appropriation, $18,000.

A survey of this site has been made, and the data reported to the bridge designer for plans.

The present structure consists of two plate girders supported upon a revolving carriage, upon a center pier. The clear opening is insufficient for the passage of the large vessels passing through Black Rock harbor, and it has a narrow roadway and no walk, making its use by the large excursion traffic which has to cross it in summer dangerous. The necessity for a new structure at this point is pressing.

CHAPEL STREET BRIDGE, LOCKPORT.

Chapter 573, Laws of 1899.

Appropriation, $16,000.

The act contemplates the erection of a lift bridge at this point, the former bridge having failed some two years ago. A survey of the site has been made and the data reported for the preparation of plans.

GLEN CREEK IMPROVEMENT, WATKINS.

Chapter 624, Laws of 1898.

Appropriation, $5,000.

Plans were approved by the Canal Board August 17, 1899, which contemplate the repairing of the pile dike on both sides of this creek, from its confluence with the Chemung canal to the Northern Central Railway bridge; the cleaning out of the channel and the reinforcing of the pile diking with the earth and gravel taken from the creek. This work will be executed during the fall of 1899.

MONTOUR FALLS, DRAINAGE OF ABANDONED CHEMUNG CANAL.

Chapter 569, Laws of 1899.

Appropriation, $3,000.

A survey of this location has been made, and a study of the conditions is being made in an effort to provide a remedy which will prove both effective and at the same time come within the limits of the appropriation.

ALLEGANY AND CATTARAUGUS INDIAN RESERVATIONS, IMPROVEMENT OF HIGHWAYS.

Chapter 569, Laws of 1899.

The sum of $5,000 was appropriated to repair the highways on the Allegany and Cattaraugus Indian reservation, under the direction of the Superintendent of Public Works; a representative of this Department at their request, made an inspection with a representative from the Department of Public Works, of the location, and discussed the scope and method of carrying out the provisions of the act, namely, the carrying on of the work previously done under chapter 606, Laws of 1898 and chapter 790, Laws of 1897.

BRIDGE OVER OAK ORCHARD FEEDER AT MEDINA.

Chapter 606, Laws of 1898; chapter 569, Laws of 1899.

Under chapter 606, Laws of 1898, $3,000 was appropriated to complete the bridging of Oak Orchard feeder in Medina, begun under chapter 791, Laws of 1896, and chapter 790, Laws of 1897, which, being insufficient, $1,500 additional was appropriated by chapter 569, Laws of 1899.

Plans have been prepared for the completion of this work, but the large increase in the cost of both labor and material have made it impossible to complete the work with the funds available. As the law required the completion of the work, no construction can be done until further funds are available.

The plans contemplate the confining of the feeder between two masonry walls, covered with a plank floor laid on steel I beams, thus forming the sidewalks on the westerly side of Shelby street, the principal business street of Medina. The engineer's estimate of cost, based upon the use of steel beams for the walk, is $7,284.55, and for an alternative plan using pine stringers, $6,159. Although the alternative plan is of a less first cost, the steel beam construction will be more durable, and make an ultimate saving.

CATTARAUGUS INDIAN RESERVATION. FOR THE CONSTRUCTION OF AN IRON BRIDGE ACROSS CLEAR CREEK.

Chapter 569, Laws of 1899.

Appropriation, $2,600.

Although an inspection revealed the imperative necessity for a new structure at this site, the act calls for an iron bridge, which estimates proved impossible to build within the appropriation, owing to the very marked advance in the price of all structural metal.

A half tone in the annual report of the State Engineer and Surveyor for 1898 clearly shows the condition of the present structure.

ERIE CANAL IMPROVEMENT.

Although no funds were available save from the appropriation for ordinary repairs, progress has been made upon the final estimates of work done under chapter 79, Laws of 1895, and acts supplemental thereto, as circumstances would permit, and it is confidently hoped that these estimates will all be completed by January 1, 1900.

The difficulties encountered in preparing these estimates greatly added to by the fact that the notes were not taken in a uniform manner, coupled with the fact that few of the employees who had charge of the actual work of construction, now remain in the service of the State.

ORDINARY REPAIRS.

From time to time, as called for, plans for lock and stopgates, bills of materials for various repairs (including bridges) have been prepared for the Department of Public Works, in fact, all requests of that Department have been honored.

In connection with the ordinary repairs, a careful inspection of every structure on this division has been made by a representative of this Department, together with representatives of the Superintendent's Department, and a detailed report rendered of the conclusions. Many of the bridges were found in such dangerous conditions as to require immediate attention.

EXTRAORDINARY REPAIRS.

Chapter 208, Laws of 1899.

Under this act the following plans have been made, or surveys made and plans in preparation, to the end that the structures may be built during the closed season of the canal.

CULVERT No. 31, EAST OF PITTSFORD.

Plans have been prepared for a cast iron pipe culvert consisting of two 30-inch pipes with necessary headwalls, etc., to replace the present composite culvert, which is in a very defective condition.

BROCKPORT CULVERT No. 59.

Plans have been prepared to replace the present box culvert (which failed two years ago with disastrous results, and which is now in a defective condition, the repairs at that time being of a temporary nature) with a 48-inch cast pipe culvert, with the usual masonry, etc.

BROCKVILLE WASTE WEIR.

The plans prepared contemplate the building of the southerly ends of the two 12 feet span masonry arches, and the entire rebuilding of the spillway, waste gates and inlet, the present structure being in a precarious condition.

SOUTH ST. PAUL ST. RETAINING WALL, ROCHESTER.

It is proposed under the plans prepared, to complete the rebuilding of this wall from the point where the work terminated under the canal improvement, to the Court street bridge, a portion of the wall having fallen in and the balance being in bad condition.

ELK STREET RETAINING WALL, BUFFALO.

The retaining wall at the southeast corner having failed, plans have been made for rebuilding same.

JACKSONS BRIDGE No. 141 AND BEALS BRIDGE No. 136.

Plans have been prepared for rebuilding Jacksons bridge No. 141 and Beals bridge No. 136, both plans being of the same type, consisting of timber bridges, with metal lower chords, greater depth of truss and section of members being provided, for the increased load now passing over them.

COURT OF CLAIMS SURVEYS.

Chapter 569, Laws of 1899.

During the year, such aid as was required, has been furnished the Attorney-General in the preparation of surveys, and attendance at sessions of the Court of Claims, when hearings of claims pertaining to this Division were held.

A complete survey has been made of the area overflowed by the break in the Spencerport waste gate, covering a length of about eight and one-half miles.

On August 1, 1899, a field party was organized under Foster B. Morss, Assistant Engineer, which has been continuously employed since in making surveys of spoil banks and lands affected by the canal improvement.

In making these surveys, the old blue line maps have been studied carefully, in connection with such field notes as are still extant, before starting the field work. The former base or survey line known as the "Red Line" has been carefully established as far as possible by offsets from existing structures, from which the blue line has been defined. The surveys of the land used for spoil have then been made, and connected with both the "blue line" and the base line of the 1897 surveys. The retracing of the latter line has been very difficult, the references and angle points having been in many instances obliterated by the canal improvement. Each angle point of every parcel of land surveyed, both along the present "blue line" and the back of the parcels, have been indicated by a piece of gas pipe from one and one-half to two and one-half feet long, driven in the ground.

As soon as possible it is my intention that these surveys shall be mapped on the 1895 survey maps, which will materially aid in the location of the blue lines thereon, and thus prove of much value in locating the blue line, which is ever the cause of so much contention.

The office work preparatory to the field work has been completed for the surveys upon contracts No. 5 and 12, and the surveys have been completed upon contracts Nos. 14 and 15.

Forty-seven parcels have been surveyed and seven and one-tenth miles covered, on both sides of the canal.

During the year this department has furnished such information and assistance to the Department of Public Works as has been requested, in the various matters which have arisen, and which were incident to the ordinary operation of the canal.

But one serious break has occurred, namely, the failure of the waste gate at Spencerport about six p. m. May 9, 1899, which caused much damage and delayed navigation until the 16th inst. In my judgment, this failure was due to a leak under the timber foundation, which found its way along the foundation under and past the cut-off walls, and washed out the berme bank on the westerly side of the masonry abutment of the waste gates. Pictures taken at the time of the break show that the berme bank was washed out before the failure of the masonry adjoining, and a latter investigation developed the fact that the sheet piling at the end of the structure was but 15 inches long, with a consequent lack of penetration, and was practically of no use as a cut-off for the water. In this connection my experience, though short upon the canals, has convinced me that the use of concrete foundations, while of greater first cost, are more economical in the end, and far safer. Many of the failures of structures in recent years are traceable to defective timber foundations.

The past year has been one of extraordinary activity in the construction of both public and private works, with the consequent demands, which have made it difficult for even energetic contractors to procure necessary labor and materials, to promptly carry out their contracts.

Many of the metal bridges upon this Division, particularly the portions below the flooring, are urgently in need of painting, and unless such provision is made at an early date, corrosion to such an extent as to impair the strength of the structures, will have taken place. The spillways at Medina, Albion, Holley and Brockport, are all in defective condition, and are only held in place by timber bracing. These structures should be rebuilt at an early date.

The apron of the Brockport spillway is badly undermined; the foundation of the towpath abutment of the Albion swing bridge, is above canal bottom, and the abutment is tipping into the canal, and should be rebuilt another winter.

The foundation of the berme abutment of the Brockport lift bridge is defective, and as the abutment is failing, it should be rebuilt in the immediate future.

The stop gate and masonry at the head of the Oak Orchard feeder are in a dilapidated condition and require attention.

Every year the State is called upon to make appropriations to repair past and prevent future damages due to floods in the area drained by Tonawanda creek, and which are attributed to the dam across this creek in the village of Tonawanda. As a means of obviating this flooding of the country, the construction of a movable dam, to replace the fixed dam, is suggested for your consideration.

The abutments and adjacent retaining wall of Commercial Street bridge at Buffalo are in bad condition and require rebuilding, and the removal of the portion of the dam used at the time of the canal improvement, and which it is feared to remove on account of this defective wall, would facilitate navigation at this point.

The dam across the Genesee river at the Rapids has gone out for approximately one-half of its width, and as a consequence the water in this river, except during high stages, is lower than the level in the canal feeder adjacent thereto. The supply stored in the Cuba reservoir can be reclaimed for canal use at this point only and through the agency of a dam, which will maintain the level of the Genesee River at this point at the height of the canal and the Genesee River feeder. In its present condition, if the feeder gates were opened, water would flow from the canal into the river instead of the reverse, as is intended, during the major portion of the year.

The berme abutment of Bidwell's bridge No. 124 is falling down and should be rebuilt.

The berme abutment of Bushnell's Basin bridge No. 50 should be rebuilt. The plans for the canal improvement contemplated this work, but work was stopped before this improvement was made.

The masonry pier supporting the berme abutment of Mill Street bridge No. 192, Buffalo, is founded upon a pile and timber foundation, from one and one-half to two feet of which, for a considerable portion of the time is exposed. This timber is badly decayed, and should be removed and a new foundation provided.

The berme abutment of Port Gibson bridge No. 30 is falling into the canal and requires rebuilding.

Examination of every structure upon this division has been made, and their conditions are noted in the following summary:

BRIDGES.

Bridges (wooden superstructures), Nos. 44, 57, 59, 118, 123, 124, 132, 136, 144, 147, 154, 160, 166A and 166C, 167A and 167C, 171 172, 183, are in a badly decayed condition and should be rebuilt at once, or travel shut off from same. Bridge No. 183 formerly led to a ferry dock, and probably can be abandoned, as the ferry does not appear to be running.

BRIDGE ABUTMENTS REQUIRING REBUILDING.

Towpath abutments, bridges 16, 32, 79, 114, 127, 128, 136, 152, 166, 167, 171, 175.

Berme abutment, bridges 7, 19, 30, 32, 47, 50, 60, 62, 79, 108, 124, 125, 128, 136, 166, 167, 169, 170, 171, 175, 178, 185, 186, 191, 192, together with the repairs to structures in the city of Buffalo requiring repairs, as noted in the annual report of the State Engineer and Surveyor for 1898.

SUPERSTRUCTURES IN NEED OF PAINTING.

Those starred thus * are in urgent need of paint to prevent rapid deterioration, corrosion or rot having started.

Lattice bridges Nos. 9, 31, 39, 62, 68,* 69,* 78, 111, 130, 140½*, 142, 146,* 148,* 151, 164½,* 175½,* 177,* 189½,* 192,* 194.*

Lattice lift bridges Nos. 4,* 77,* 86* and 108.*

Whipple arch bridges Nos. 5, 24, 32,* 40, 47, 49, 50, 53, 58, 64,* 66, 67, 82, 95, 99, 100, 101, 107, 110, 112, 114,* 115,* 116, 119, 120, 121, 131, 133, 135, 137, 139, 140, 145, 155, 156, 157, 164,* 165, 166B, 178,* 179,* 182, 186,* 189.

Bollman wrought iron bridges Nos. 76, 127* and 180.*

Swartz cast iron bridges Nos. 117, 125.

Bowstring bridges Nos. 70, 87,* 113,* and 175.*

Plate girder bridges Nos. 25 and 196 (under floor).

Pipe bridges Nos. 35, 65, 79, 90, 91,* 169A,* 169B,* 170, 176, 181, and 188.

Whipple trapezoidal bridges Nos. 90, 91, 102, 161,* 167B.

Pratt truss bridges Nos. 159, 174A, and 174B.

Swing bridges Nos. 128,* and 195.*

Deck truss arch bridges Nos. 162,* and 163.*

Arch culverts Nos. 4, 5, 22, 23, 41, 46, 49, 50, 51, 52, 53, 57, 61, 63, 64, 66, 67, 68, 69, 70 (Brockville waste weir on berme end, plans for rebuilding have been prepared), 72, 73, 74, 76, 77, (Albion waste weir on berme end), 86, 90, 93, 97, 102, 110, 111, 113, 117, 119, 120 and 121, require rebuilding on both ends.

Culverts No. 34, 34½, 47, 82, 89, 107 and 109, need rebuilding on towpath end, and culverts 6, 10, 88 and 95 need rebuilding on berme end.

The wings on both ends of arch culverts Nos. 19, and on the towpath end of culverts Nos. 101 and 118, need repairs.

The following composite culverts need the repairs indicated: All of these composite culverts were built prior to 1854, and while they have been patched and repaired from time to time, the cost of keeping these culverts in repair amounts to more than enough to substitute pipe culverts, while often repairs are made, there is always an element of doubt as to their safety. Originally all of this style of culverts were "Dive culverts," but in many cases the conditions have changed since they were constructed, and the timber is now exposed to the air.

Both ends Nos. 12, 13, 17, 31 (iron pipe culvert to be built here during winter 1899 and 1900), 48, 59 (iron pipe to be substituted during the coming winter), 62, 83, 84, 85, 87, 104 and 115.

Towpath end Nos. 80, 81, 91 and 114.

Berme end Nos. 15, 24, 90 and 114.

Culverts Nos. 100, 105 and 116 should be rebuilt entirely.

The masonry at both ends of iron pipe culverts Nos. 11, and the berme end of No. 9 should be repaired.

LOCKS.

All of the locks except Sulphur Spring Guard lock upon this division require repointing, and more or less repairs to foundations.

AQUEDUCTS.

Lyons and Palmyra aqueducts. Joints of towpath and berme masonry leak badly and should be pointed.

Rochester aqueduct needs entire new towpath plank and towpath railing.

Medina aqueduct leaks badly.

There is also a considerable leak around the retaining wall on berme side of canal east of the aqueduct, which should be followed up and repaired.

STOP GATES.

Cartersville stop gate is in very bad condition and should be entirely rebuilt; Bushnell's Basin stop gate requires retimbering and new gates; Adams' Basin needs entire new bulkhead, and Holley (West gate) needs a new gate. The foundation timbers of Rochester stop gate (gates are removed) should be taken out, as they now impair navigation.

None of the vertical or slope walls, westerly of Rochester, except those rebuilt under the canal improvement, are in good shape, most of it being little better than rip rap. Much of the towpath needs repairing.

During the past season, much excellent work of improvement of the towpath has been done by the Department of Public Works, which, if carried on, will soon put all of the towpath in good condition.

ROAD IMPROVEMENT.

During the fall of 1898 surveys were made of the following stretches of road to ascertain the advisability of improving them by State aid, under chapter 115, Laws of 1898, known as the "Higsby-Armstrong Good Roads Law."

Whites Corners plank road, Erie county, between the southerly line of the city of Buffalo and the northerly line of the village of Hamburg, except through the incorporated village of Blasdell, a distance of 6.54 miles.

River road, Erie county, being a highway paralelling the Niagara river, running from the northerly city line of Buffalo to the Grand Island ferry, a distance of about one mile.

Little Ridge road, Monroe county, between the northerly city line of Rochester and the westerly line of the town of Greece, a distance of 6.53 miles.

East avenue road, Monroe county, between the easterly line of the village of Brighton and the Fairport and Pittsford fork, a distance of 2.45 miles.

Southport road, Chemung county, between the southerly line of the city of Elmira and the boundary line between the State of New York and Pennsylvania, a distance of about 6.5 miles.

Monroe avenue, Monroe county, from the southerly line of Rochester easterly to the Erie canal, a distance of 4.3 miles.

Plans have been prepared for the improvement of all of these roads excepting the river road in Erie county, and Monroe avenue in Monroe county, and contracts entered into for the construction of the Whites Corners plank road, Erie county, and the Little Ridge road and East avenue road, Monroe county.

This being the first year of the operation of this law, the experience gained may possibly prove of value in succeeding years, for which reason I take up separately each road upon which work has been done, and go into greater detail than I should do otherwise.

Most of those upon this division who have had to do with road work during the past year had had some previous connection with road work; all have gained experience which cannot but prove of value in future constructions of this nature.

The early plans were carefully revised, and in many instances grades were changed, with the elimination of excessive cuts and embankments, experience having demonstrated that on many of the roads which had been "worked" from year to year, that the old surface, while unfit as a surface, could readily be utilized with a small amount of work, and made into a far better subgrade than could be provided by cutting off the old surface or making a fill over it (the rate of grade, of course, being at all times considered); that long straight grades are not only not essential, but that rolling grades, within reasonable limits, are preferable and less fatiguing to draft animals has been demonstrated. Wide wings are not only inadvisable, but in bad weather are a detriment.

The metaling, if well proportioned, is the section of the road utilized, and should always be wide enough for two teams to pass. Wings of excessive width increase the cost and have no utility.

The use of iron pipe to carry drainage under farm crossings seems an unnecessary expense. The length of these crossings have been 12 feet in the majority of cases. This, upon first consideration, would seem ample, but when it is remembered that the farmer coming onto the road has usually to make a turn of a right angle, and that the width of road in which he turns is between 20 and 24 feet, it becomes apparent that it is a difficult matter to keep the team out of the opposite ditch, in keeping the wagon on the crossing. As a remedy for this I would suggest the use of tile known as seconds, but which have no defects affecting their structural strength, the length of the crossings to be 18 feet long. Inasmuch as the minimum depth of ditch used is 18 inches, upwards of a foot of covering over a 12-inch pipe may be obtained by having the crown of the roadway and the crown of the crossing intersect at the center of roadway, as is the general practice in laying city pavements at cross-streets.

The present specifications call for one-half inch limestone screenings free from dust. It has been found impossible to properly fill the voids (amounting to nearly 50% of the whole), and bind the metaling with screens of this nature.

Best results have been obtained by deviating from the specifications and the use of smaller screenings ranging from ½-inch down to, and including from 10 to 20% of stone dust, the finer particles of stone predominating. These we have been able to work to the bottom of the road, and with a very liberal use of water, a puddle, much resembling mortar, is produced, the stone being bedded in place with the roller until a lather appears upon the surface. After being thoroughly puddled in this manner and then allowed to dry out, the metaling serves as a roof, shedding the water to the side ditches and keeping the foundation dry, which seems to be the fundamental principle of good roads, especially so, where but six inches of metaling are used.

Some provision should be made to carry off rain and such other water as gets upon the subgrade and is held in the channel produced by the wings during construction, prior to the final puddling of the metaling, especially on sharp grades.

On all roads built on this division during the past year, "Weep holes" have had to be dug, even upon sandy soils. These weep holes are a disadvantage, as they prevent the rolling of the wings simultaneously with the surface course. The laying of 2-inch ordinary farm tile from the metaling to the edge of the ditch, or the building of small blind drains of broken stone, would accomplish the desired results, the former being preferable, in my judgment, but neither would add materially to the cost of construction. Two-inch farm tile are 13 inches long, weigh 4 pounds per length, and cost about $8 per thousand pieces at the factory. Spaced 100 feet apart on both sides of a road with 3 feet wings would cost between six and seven dollars per mile in place.

The advisability of insisting upon the delivery of necessary material along the road to be improved, section by section, before the road is torn up, is recommended for your consideration.

During the past summer traffic has been seriously delayed, due to the long periods that the highways have been impassable (except with great risk) due to the inability of the contractor to secure necessary material to promptly complete their work.

While the past season has been an unusual one, and contractors in all lines of work have been unable to secure satisfactory quantities of labor and materials, due to the remarkable volume of both public and private improvements under construction, still there are always so many conditions which even the most capable and efficient contractors cannot govern, that in my judgment some provisions of this nature should be insisted upon.

Wide tires are naturally called to mind in connection with road improvements. An excellent demonstration of the beneficial results of wide tires was provided during the construction of the Ridge road. This work was begun in September and carried on during a rainy spell. The hauling of the crushed stone took place over about a mile of ordinary country farm road, which seemingly had never had any attention other than an occasional scraping of the road with a road machine. This road, when teaming was started, was in a frightful condition, with very bad ruts; as its use continued, under the influence of wide tires (no teams except with wide-tired wheels were employed by the contractors), and a little good judgment, the road rapidly smoothed out, and although the weather conditions were adverse, it was levelled and compacted, and assumed an excellent condition, with a resultant increase of work done per day by the teams. A clause in the specifications insisting upon the use of vehicles with wide tires by the contractors seems to me advisable. The agriculture experiment station of the University of Michigan, in their bulletin, No. 30, published in July, 1897, gives the result of a series of careful and thorough tests upon the influence of the width of tire on draft wagons. The results are of such interest in this connection that I am led to quote in its entirety the summary of results, by H. J. Waters, director, with the hope in this way of reaching many interested in this subject to whom the bulletin is not available:

"Numerous tests of the draft of wide and narrow-tired wagons have been made at this station during the past two years, on macadam, gravel, and dirt roads in all conditions, and on meadows, pastures, and plowed fields, both wet and dry. The draft has been determined by means of a self-recording dynamometer. The net load was in every trial the same, viz., 2000 pounds. Contrary to public expectations, in a large majority of cases, the draft was materially less when tires six inches in width were used than when the tests were made with standard width, 1½ inches. The following is the summary of the results:

1. On macadam street, as an average of the two trials made a load of 2518 pounds could have been hauled on the broad tires with the same draft that a load of 2000 pounds required on the narrow tires.

2. Gravel road. In all conditions of the gravel road, except wet and sloppy on the top, the draft of the broad tired wagon was very much less than that of the narrow tired wagon. Averaging the six trials, a load of 2482 pounds could be hauled on the broad tires with the same draft required for a load of 2000 pounds on the narrow tires.

3. Dirt roads. (a) When dry, hard, and free from ruts and dust, 2530 pounds could have been hauled on the broad tires with the same draft required for 2000 pounds on the narrow tires. (b) When the surface was covered with two or three inches of very dry, loose dust, the results were unfavorable to the broad tire. The dust on the road in each of these trials was unusually deep. (c) On clay road, muddy and sticky on the surface and firm underneath, the results were uniformly unfavorable to the broad tires. (d) On clay road, with deep mud and drying on top, or dry on top and spongy underneath, a large number of tests showed uniformly favorable to the broad tire. The difference amounted from 52 to 61%, or about 3200 pounds could have been hauled on broad tires with the same draft required to draw 2000 pounds on the narrow tires. In this condition of road the broad tires show to their greatest advantage. As the road dries and becomes firmer, the difference between the draft of the broad and narrow tires gradually diminishes until it reaches about 25 to 30% on dry, hard, smooth dirt, gravel or macadam road, in favor of the broad tire. On the other hand, as the mud becomes softer and deeper, the difference between the draft of the two types of wagons rapidly diminishes until the condition is reached when the mud adheres to both sets of wheels; here the advantage of the broad tires ceases entirely, and the narrow tires pull materially lighter. (e) Clay road, surface dry, with deep ruts cut by the narrow tires in the ordinary use of the road. In every trial, the first run of the broad tire over the narrow tire ruts has shown a materially increased draft when compared with that of the narrow tire run in its own rut. The second run of the broad tires in the same track where the rut is not deep completely eliminated this disadvantage, and showed

a lighter draft for the broad tire than the narrow tire showed in the first run. Where the ruts were 8 inches deep, with rigid walls, three runs of the broad tire in its own track over the ruts were required to eliminate the disadvantage. Three runs of the broad tire over this track have in all cases been sufficient, however, to so improve the road surface that both the broad and narrow tired wagons passed over this road with less draft than the narrow tires did in the original ruts. In addition to the saving of draft, the road was made very much more comfortable and pleasant for the users of light vehicles and pleasure carriages by the few runs of the 6-inch tire. Summing up all the tests of dirt roads, it appears that there are but three conditions on which the broad tires draw heavier than the narrow tire, viz., (1) When the road is sloppy, muddy or sticky on the surface, and firm or hard underneath; (2) When the surface is covered with a very deep, loose dust, and hard underneath; (3) When the mud is very deep and so sticky that it adheres to the wheels of both kinds of wagon. It appears that the dust must be extraordinarily deep to show a higher draft for the broad than for the narrow tires. Three conditions just named, therefore, are somewhat unusual and of comparatively short duration. Through a majority of days in the year, and at times when the dirt roads are most used, and when their use is most imperative, the broad tired wagons pull materially lighter than the narrow tired wagon.

4. A large number of tests on meadows, pastures, stubble land, corn ground and plowed ground in every condition, from dry, hard and firm to very wet and soft, show without a single exception a large difference in draft in favor of the broad tires. This difference ranged from 17 to 120 per cent.

5. It appears that 6 inches is the best width of tire for a combination farm and road wagon, and that both axles should be the same length so that the front and hind wheels will run in the same tracks.

It impresses me that a great step in aid of good roads would be obtained, could State aid carry with it the requirement of wide tires upon vehicles using such roads after their completion in the same manner as it now does the payment of road taxes in money. There are now on the market wide tires which can be applied to most ordinary wheels, costing about $2 per wheel, so that the enforcement of this law need not work a great hardship.

Special reference to these adjustable tires are made in "Highway Manual of New York" pages 329 to 331, and in United States Department of Agriculture, Farmers Bulletin No. 95, on page 24.

Where bridges or large masonry culverts upon roads to be improved require rebuilding, it seems to me proper that such reconstruction should be accomplished by the local authorities, thus obviating the use of any portion of the available funds for this purpose, and permitting its use for road construction only. During the past season in two instances, where structures were unsuited for the heavier class of traffic which the road improvement made possible, the town authorities willingly built stone arches, namely, at Big Tree on Buffalo and Hamburg road, Erie county, and Allens Creek on East avenue, Monroe county.

The advisability of having suitable tests of the harder or flinty grades of limestones found in the westerly portion of the State, with the view of their possible adoption for wearing surfaces on roads built upon this Division is recommended to your consideration. Such stone is found, to the writer's knowledge, in the vicinity of Buffalo and Le Roy, and has been largely used with satisfactory results in those localities. A strata of a hard, corniferous stone exists near Elmira which will possibly prove suitable, although I have no knowledge as to its extent. If it were known that such tests were being made, suitable stone would probably be submitted from other localities.

I am constrained to make this recommendation inasmuch as so much difficulty has been experieneed during the past year in securing trap rock, that I fear highway commissioners will be unable to secure necessary trap for repairs, together with the fact that usually in unskilled hands, better results will be obtained by the use of a suitable limestone than by the use of trap.

Whites Corners plank road, Erie county, between the southerly line of Buffalo and the northerly line of the village of Hamburg, except through the village of Blasdell, chapter 115, Laws of 1898; length 6.54 miles.

Contract dated	Oct. 4th, 1898.
Contract to be completed	Dec. 31st, 1898.

Contractor, H. P. Burgard.

Appropriation	$36,400 00
Engineer's estimate	35,011 25
Contract price	24,750 00
Estimated to October 1, 1899	20,380 00

Engineer in charge, G. C. Diehl, Erie county engineer, season of 1898; G. E. Greene, season of 1899.

A majority petition for this improvement was presented to the Erie county board of supervisors April 12, 1898, and at that meeting it was determined that public interests demanded the improvement. The approval of the petition was made by the State Engineer and Surveyor to the board of supervisors under date of June 16, 1898.

Plans and estimates were submitted to the board by the State Engineer and Surveyor, under date of August 1, 1898, and were approved by the board of supervisors August 5, 1898, the treasurer of Erie county then being authorized to pay one-half the cost of construction of the road, not exceeding $18,200 upon the requisition of the State Engineer.

A contract was entered into October 4, 1898, with Henry P. Burgard, who promptly began operations on October 10, following, starting at the northerly or Buffalo end.

All masonry and the bridges called for by the plan were completed, grading of about 1½ miles, and metaling put on about 1 mile, prior to December 3d, when the work was closed for the winter, the weather during most of the time having been unsuitable for prosecuting this class of work.

An inspection last spring demonstrated the necessity of extensive repairs and additions to the work of the previous fall. Work was resumed June 5, 1899; the old work was first gone over carefully and put in good condition, then the work was continued southerly, and has been progressed in an energetic and satisfactory manner up to the present time.

When work was resumed, at the beginning of the summer, it was found that a better road could be constructed by utilizing, as far as possible, the old road surface (after being properly shaped) for the subgrade. The profile was for this reason somewhat modified and in this way, difficulties with a peculiar greasy quicksand were very much lessened and the final grades improved as well.

This road, which carries a very heavy garden truck traffic (being the principal highway leading southerly from Buffalo) is essentially a dry weather road, the soil being of a clayey nature, soft shale rock, quicksand or mixtures of two or more of same. The quicksand encountered was mostly of a peculiar greasy combination of sand and disintegrated shale, which would quiver and quake for some distance when walked upon if wet, but which would become hard and firm when thoroughly dried out. This condition made it particularly necessary to keep the ditches and other devices for drainage well ahead of the work, at all times. The preparation of the finished subgrade was so carried on that the lower course of metaling was usually not more than 800 to 1,000 feet behind, to avoid excessive teaming over it, as well as not to leave long stretches liable to be badly wet by rain. Where the subgrade was in clay or rock, from three to six inches were removed, and gravel or shale thoroughly compacted put in place, before the application of the metaling. When the foundation was in sand (not quick) the foundation was thoroughly soaked with water, and a thin layer of stone spread or rolled before it dried out, the entire lower course of stone was applied as soon as possible.

Where quicksand was encountered, it was removed and replaced with selected material as far as possible; in any event, to a sufficient depth, so that a stable foundation was procured for the road.

In the vicinity of Big Tree, a large pocket of quicksand was encountered, which was filled with railroad ties, forming a grillage, together with large boulders and numerous blind drains, which, after much labor, produced a solid foundation.

The stone used was a flinty grey limestone, from North Buffalo quarries, being similar to what is generally used for road work in Buffalo, and with which most satisfactory results have been obtained. The bottom course of 4 inches (after rolling) ranged from 1¼ to 2½ inches in size, and the top wearing course of 2 inches in depth, varied from ½ to 1¼ inches. One-half-inch stone was used for a filler for the lower course, and a mixture of ½ and ⅛-inch binder stone for the wearing surface. The operation of placing the metaling was as follows:

Six inches of the 2½-inch stone were spread evenly over the prepared subgrade, then rolled from the outer edges to the center until the stone were well locked together, and firm; upon this was spread a layer about ½ inch thick of ½-inch screenings. (These were used free from stone dust at first, but experience showed better results with a small percentage of dust, and were so used later), which were then rolled and brushed into the voids as thoroughly as possible dry, and then washed in with liberal applications of water.

The 6-inch layer loose, was found to roll to 4 inches.

Three inches of 1¼-inch stone (which rolled to 2 inches) were then put on and rolled smooth; upon this a mixture of ½ and ⅛-inch screenings were applied, rolled and brushed in thoroughly; this was then puddled by drenching with water, during which operation screenings were successively applied, as their necessity became apparent, until all voids were filled, and a mortarlike roll preceded the roller. After being allowed to thoroughly dry out, a coating of screenings was spread over the entire surface as a wearing cushion, and to provide dust after being worn by traffic, to fill such small voids as developed. This road has been found to improve with traffic as far as present observation may determine, one section having been subjected for three months to severe use. It is confidently hoped to complete this work during the present season.

The folowing data has been obtained during construction and is here given as a fair basis when work is systematically done, as was the case upon this contract:

Between Stas. 243+50 and 81+25, a distance of 16,225 feet, the following amount of stone of the various sizes were used, the measurements being loose yards: 2½-inch or foundation stone, 3375 cubic yards; 1¼-inch or surface stone, 1555 cubic yards; ½-inch binder stone, 524½ cubic yards; ⅛-inch binder stone, 659 cubic yards.

It was found that the 2½-inch foundation stone spread 6 inches deep over the width of the road (12 feet), rolled to 4 inches deep, and covered 4 8-10 linear feet, or 1 cubic yard loose, rolled to 0.595 cubic yards, or a decrease due to rolling of 40½ %. One and one-quarter-inch stone for wearing surface was spread loose 3 inches deep and rolled to 2 inches, 1 cubic yard covering 10.4 linear feet of 12-foot road, or 1 cubic yard loose, rolled to 0.706 cubic yards in place, a decrease of 29.4%, due to rolling.

One cubic yard of the ½-inch stone screenings covered 31 linear feet of the 2½-inch stone, and 1 cubic yard of the ⅛-inch stone screenings spread over 24.6 feet of the 1¼-inch stone. The amount of ⅛-inch and ¼-inch screenings, used to fill the voids, was about 24% of the loose yardage of the 2½ and 1¼-inch stone used, to which must be added such screenings as were put upon the surface as a wearing cushion.

The average haul of the stone from the cars upon the siding to its place in the road was 3470 feet.

The grading between Stas. 81 and 133+80 (1 mile) including the making of the cuts, fills, ditches, and preparation of subgrade, required the following labor (this was a fair average mile):

Foreman 39 days, at $2.50	$97 50
Labor 459 days, at $1.50	688 50
Water boy 18 days, at $1	18 00
Teams 67 days, at $3.50	234 50
Total cost per mile	$1,038 50

The cost of the ditching on the above mile was as follows:

Foreman 14 days, at $2.50	$35 00
Labor 213 days, at $1.50	319 50
Water boy 6 days, at $1	6 00
Teams 31 days, at $3.50	108 50
Total cost of ditches per mile	$469 00

Cost per cubic yard, 13 cents.

When the grade was practically the old surface and only required breaking up, and forming the subgrade and wings, the cost was approximately $320 per mile.

The cost of the 2½-inch stone was 65 to 75 cents per cubic yard loose; 1¼-inch, 70 to 85 cents, and ½ and ⅛-inch, 75 to 95 cents f. o. b. cars at Buffalo, on which a freight was charged of 25 cents per ton, or 27½ cents per cubic yard.

The cost of manipulation, per cubic yard (loose) from the cars to its place in the road was as follows: Unloading from cars 11 cents; hauling, 28 cents; spreading and leveling, 8 cents; rolling metaling and subgrade, 24 cents; sprinkling, 19 cents. To these prices, of course, a percentage of profit needs to be added, as well as a percentage (not determined) for damage to subgrade by teams and the elements.

East avenue road, Monroe county, between the easterly line of the village of Brighton and Pittsford, length 2.45 miles. Chapter 115, Laws of 1898.

Contract dated, March 6, 1899.

Contract to be completed July 15, 1899.

Contractors, Gillette and Gillette.

Contract price	$10,500 00
Engineer's estimate (exclusive of engineering)	10,993 00
Estimate to October 1, 1899	4,410 00

Engineer in charge, M. W. Wilbur.

A majority petition was presented to the Monroe county board of supervisors for this improvement, May 17, 1898, and at the succeeding meeting, held May 23, 1898, it was declared a public necessity.

On November 21, 1898, plans at an estimated cost of $12,200, were submitted by the State Engineer, and were adopted by the board of supervisors, on November 30, 1898.

On March 6, 1899, a contract for this work was entered into, with Messrs. Gillette and Gillette for $10,500.

Those interested in this road had become dissatisfied with the width of the metaling, namely 12 feet, and an effect was made to increase its width to 16 feet. By request, the grades were revised, and excavation decreased materially, and the Country Club were permitted to enter into an agreement to widen the metaling from 12 to 16 feet, between Brighton and Allen's creek, the proposition to widen the balance of the metaling, having fallen through, due to the inability of the property owners to raise the necessary funds.

The starting of the work was somewhat delayed, pending the question of widening the macadam, and work was begun June 12, 1899.

The first work done was the grading east from Allen's creek. After completing the rough grading east of Allen's creek, work was transferred to the westerly side of this creek, as the town of Brighton began the construction of a new stone arch across this stream, which cut off the delivery of stone from the quarry to the east end. Innumerable and vexatious delays have characterized this work from the start, due to lack of tools and inexperience of the contractors, in this class of work, coupled with an inability to get the trap rock from the Hudson river, which they had arranged for.

The soil upon which this road is to be built is a light sand, easterly of Allen's creek, running to a sandy loam at the westerly end of the road.

Easterly of Allen's creek the road had practically no attention and in places had as many as three tracks. The sand, in dry weather, is so loose that wheels settle from three to six inches into it.

West of Allen's creek, the road had been worked more or less, and considerable quantities of stone had been used, so that the road was a fair, dry-weather highway.

This road is being built with a foundation of 4 inches (when rolled) of local grey limestone, from a quarry about one-quarter of a mile northerly of East avenue, in the bed of Allen's creek. The top, or wearing surface, is of 2 inches (when rolled) of Hudson river trap rock over the middle 12 feet, and local grey limestone over the outer 2 feet on either side. Screenings of local grey, Buffalo and Tomkins cove limestone have been used.

At this date, the impossibility of completing this work during the present season is apparent. A very large traffic occurs upon this road and it has been impossible to keep the road closed, as barricades were destroyed as rapidly as they were put up, due, in a measure, possibly, to the dilatory work of the contractors, although every effort was made by us to hasten the work.

The process of manipulating the materials has been similar to the operation upon the White's Corners plank road, and previously described.

Between Stas. 36 and 61, a distance of 2500 feet, it was found that 675 cubic yards of broken limestone for the foundation, rolled to 494 cubic yards in place, or a shrinkage of about 27%. It was found necessary to distribute about 5½ inches of loose stone to roll to 4 inches.

70 cubic yards of local and Buffalo limestone screenings were used to bind the wearing surface between Stas. 40+75 and 55+50, a distance of 1475 lineal feet, or nearly 50% of the volume of the rolled stone.

These screenings had been freed from stone dust, and although rolled until they began to cobble, would not properly bind. 10 cubic yards of stone dust were then sprinkled over the road, and we were able to successfully bind the surface, for this reason a portion of the stone dust was left in the screenings used afterwards, and much more satisfactory results were obtained.

Little Ridge road, Monroe county, between the northerly city line of Rochester and the westerly line of the town of Greece. Length, 6.53 miles. Chap. 115, Laws of 1898.

Contract dated August 16, 1899.

Contract to be completed November 15, 1899.

Contractors, Chambers and Casey.

Appropriation, $39,000.

Engineer's estimate (exclusive of engineering), $36,000.

Contract price, $36,800.

Estimated to October 1, 1899, $4,320.

Engineer in charge, G. O. House.

On May 23, 1898, the Monroe county board of supervisors passed a resolution declaring the improvement of this road a public necessity. On December 1, 1898, plans, submitted by the State Engineer and Surveyor at an estimated cost of $26,642.60, were approved.

Bids for this improvement were received, but in the meantime, interested property holders had decided that they preferred a trap rock surface to the limestone surface provided for, as well as an increase in the width of the metaling from 12 to 16 feet.

New plans were prepared, and the grades revised, with a marked diminution of excavation. The wings were reduced from 11.5 feet to 5 feet in width, the metaling increased from 12 to 16 feet in width, and a local sandstone foundation course, and a trap-rock wearing course adopted.

These plans were approved by the board of supervisors, June 10, 1899, and a contract entered into, with Chambers and Casey, August 16, 1899.

Work was started at the westerly end August 30th, and has since been prosecuted with much vigor.

A crushing plant was erected upon the "Hen Peck" road, about one-half mile southerly of the Ridge road, consisting of two crushers, with the customary screenings, conveyors and bins, having a daily capacity of about 125 cubic yards of crushed stone per day. The stone used for the foundation is a hard sandstone cropping out along a ridge parallel with Lake Ontario, and was undoubtedly a glacial deposit, being of a much harder texture than any of the quarry stone of that section, (which is of a soft argillaceous character), and which resembles the hardest grade of Medina sandstone. These boulders show no effects of weathering, and have sharp edges of fracture.

On October 1st, 7,600 lineal feet of road had been graded (exclusive of ditching) and the 4-inch sandstone foundation course rolled. But a small portion of this has been bound with screenings, due to delay in their arrival. Limestone screenings are to be used, and are en route from Le Roy, and Tomkins Cove. Difficulty is also being encountered in securing the necessary trap rock from the Hudson river, due to a scarcity of canal boats, and other causes, which will probably render impossible, the completion of this road during the present season.

This road is 100 feet wide between property lines, and of a light sandy nature, with the result that traffic has wandered from side to side over practically the entire width, each one taking the best road, as it appeared to them at the time. Quicksand pockets have been frequently encountered and been filled with large stone, and the sand removed until a stable foundation was produced. Owing to the porous nature of the soil, the necessity of always keeping the ditches in advance of the metaling was not necessary.

Careful experiments were made by G. O. House, assistant engineer, assisted by T. B. Smith, chainman, to ascertain the amount of the voids in the stone used upon this road, it being found that both the trap rock and the sandstone used, had 40% of voids. The trials by water displacement, and comparative weights corroborating each other. Observation and measurements seem to substantiate the view, that the use of the steam roller, reduced the volume of the voids over their best efforts about 35%, from which it is readily found that for a road 16 feet wide and 6 inches of metaling (rolled) 10.36 cubic yards of screenings are required to fill the voids only, and to this must be added the screenings from ¼ to ½-inch deep, spread over the road as a cushion or wearing coat, and which provides dust after the use of the road, by traffic, to bind any small spots that might otherwise develope and require attention.

The native sandstone cost 10 cents per cubic yard. The cost of hauling, (an average of ½ mile) to the crusher, unloading and crushing was 81 cents per cubic yard, and the cost of hauling an average of 1 mile and spreading on the work, was 35 cents, making the cost of this stone $1.26 per loose cubic yard, or $1.75 per consolidated cubic yard. The cost of limestone screenings f. o. b. canal boat at South Greece was $1.55 per cubic yard, the cost of unloading 25 cents, hauling (2 miles) 30 cents, spreading on grade 15 cents, making the total cost per cubic yard of screenings, spread upon metaling, $2.25 per cubic yard, and the cost of necessary screenings per cubic yard of rolled foundation, 80 cents. The cost per cubic yard, for rolling and sprinkling was found to be 8 cents, thus making the total cost per cubic yard of rolled metaling for foundations complete $2.63.

The trap rock costs $1.55 per cubic yard, f. o. b. canal boat at South Greece, the cost of unloading was 27 cents, of hauling (2 miles) and spreading, 47 cents, making a total cost of $2.29 per loose cubic yard, or $3.11 per consolidated cubic yard upon the road. Screenings to bind 1 cubic yard of trap, cost 79 cents; for rolling, puddling, etc., 52 cents per cubic yard of trap, making the total cost per cubic yard of trap rock surface complete $4.42.

This Division was in charge of J. L. Little as division engineer, until succeeded by the writer, February 10, 1899; C. R. Neher as resident engineer and M. W. Wilbur as first assistant engineer, and the various other employees have served in their several capacities as more fully set forth in the annexed table of statistics.

In closing, I desire to testify to the fidelity and the painstaking efforts of every employee who has served under my direction during the past year, as well as their ready and cheerful co-operation in endeavoring to properly carry on the work of this office.

For the many courtesies which you have extended to me I remain deeply grateful,

Respectfully submitted,

A. J. ROCKWOOD,

Division Engineer.

WESTERN DIVISION—ERIE CANAL.

Table of Contracts Finished during the Year Ending September 30, 1899.

CONTRACTOR.	Contract signed.	Date of final estimate.	Character of work.	LEGISLATIVE ACT.		Appropriation.	Engineer's estimate.	Contract price.	Final estimate.
				Chap.	Laws.				
W. A. Gillette	Oct. 9, 1897	Dec. 21, 1898	Improving Cayuga Creek	559	1897	$5,000 00	$4,380 00	$2,870 00	$3,796 76
Rochester Bridge and Iron Works	July 8, 1898	Sept. 9, 1899	Fitzhugh street lift bridge, Rochester	32 606 477	1897 1898 1899	27,000 00	25,969 75	23,931 50	24,475 73
Rochester Bridge and Iron Works	Mch. 12, 1898	Aug. 18, 1899	South Clinton street bridge, Rochester	339 477	1897 1899	20,000 00	19,729 50	15,862 00	16,850 22
B. P. Smith	Mch. 10, 1898	Aug. 3, 1899	Monroe avenue bridge, Rochester	207 607 477	1897 1898 1899	36,000 00	29,701 65	25,494 00	33,303 20
John Calnan	Jan. 10, 1898	June 27, 1899	Repairing and rebuilding culverts Nos. 42, 43, 45 and 56	566	1897	....	9,127 00	8,860 15	10,669 18
Buffalo Dredging Co.	Feb. 24, 1898	Mch. 21, 1899	Hamilton street bridge, Buffalo	568	1897	10,000 00	8,055 00	7,497 06	9,285 17
Chambers & Casey	Nov. 29, 1897	Apr. 14, 1899	Exchange street lift bridge, Rochester	514 *572 791 506	1895 1897 1897 1898	25,000 00 15,000 00 6,545 74	41,337 00	35,196 25	46,544 99

* Reappropriated.

WESTERN DIVISION—ERIE CANAL.

Table of Contracts pending September 30, 1899.

CONTRACTORS.	Contract signed.	Character of work.	LEGISLATIVE ACT.		Appropriation.	Engineer's estimate.	Contract price.	Estimated to date.
			Chapter.	Laws.				
Gillette, Hay & Gillette	Aug. 3, 1899	Improving channel of Newtown creek.	949 791 607	1896 1897 1898	$5,000 00	$4,330 00	$3,945 00	$3,020 00
Havana Bridge Works	May 16, 1899	South ave. lift bridge, Brighton	618	1898	25,000 00	24,059 50	22,498 00	....
Hilton Bridge Construction Co	May 29, 1899	"New Home bridge"	630	1898	15,000 00	11,610 00	10,641 50	....
B. P. Smith	April 21, 1899	Main st. bridge, Pittsford	504	1898	19,000 00	17,042 50	16,541 00	....
Buffalo Bridge & Iron Works	Mch. 23, 1899	Erie st. bridge, Buffalo	611	1898	27,000 00	22,893 50	18,723 00	....
Gillette, Hay & Gillette	April 21, 1899	Delaware st. culvert, Tonawanda	632	1898	6,000 00	5,267 00	4,708 75	2,993 00
James B. Donnelly	Nov. 10, 1899	Dredging a portion of Erie basin	635	1898	30,000 00	25,520 00	23,988 00	1,554 00
		Improvements of Public Highways.						
Henry P. Burgard	Oct. 4, 1898	Whites Corners plank road, Erie county	115	1898	36,400 00	35,011 25	24,750 00	20,380 00
Gillette & Gillette	Mch. 6, 1899	East ave. road, Monroe county	115	1898	12,200 00	10,993 00	10,500 00	4,410 00
Chambers & Casey	Aug. 16, 1899	Ridge road, Monroe county	115	1898	39,800 00	36,000 00	36,000 00	4,320 00
		Canal Improvement Work.						
Buffalo Dredging Co	Nov. 4, 1896	Contract No. 2	78 794 43 569	1895 1896 1897 1897	9,000,000 00	287,834 00	291,686 25	444,210 00
Charles T. Parker & Co	Nov. 7, 1896	Contract No. 3				312,510 00	188,541 75	88,060 00
Grannis & O'Connor	Jan. 23, 1897	Contract No. 5				227,102 50	217,119 50	276,192 27
Furnaceville Iron Co	Sept. 23, 1897	Contract No. 6				166,090 00	165,800 00	61,600 00
Baker & Banker	Sept. 3, 1897	Contract No. 7				99,725 00	98,760 00	75,140 00
Williams, McNaughton & Bapst	Sept. 21, 1897	Contract No. 8				191,090 00	184,095 00	82,720 00
Furnaceville Iron Co	Sept. 23, 1897	Contract No. 9				114,440 00	111,000 00	80,190 00
Furnaceville Iron Co	Sept. 23, 1897	Contract No. 10				152,090 00	135,500 00	38,420 00
Furnaceville Iron Co	Sept. 23, 1897	Contract No. 11				116,385 00	110,100 00	57,558 68
Furnaceville Iron Co	Sept. 23, 1897	Contract No. 12				96,540 00	87,000 00	31,810 00
Henry C. Allen & Co	Sept. 18, 1897	Contract No. 13				119,727 50	105,850 00	78,160 07
Whitmore, Rauber & Vicinus	Sept. 20, 1897	Contract No. 14				169,830 00	159,695 00	80,730 00
Whitmore, Rauber & Vicinus	Sept. 20, 1897	Contract No. 15				90,915 00	88,595 00	84,160 00

STATEMENT SHOWING THE NAMES, RANK AND COMPENSATION OF ENGINEERS EMPLOYED ON THE WESTERN DIVISION OF THE NEW YORK STATE CANALS, TOGETHER WITH THE INCIDENTAL EXPENSES FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1899.

Extraordinary Repairs—Monroe Avenue Bridge, Rochester.

(Chapter 207, Laws 1897; Chapter 607, Laws 1898, and Chapter 477, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	....	$200 per mo.	....	$7 40	$7 40
M. W. Wilbur	First asst. engineer	6	$6 00	$36 00	....	36 00
C. T. Middlebrook, Jr.	Asst. engineer	36	5 00	180 00	1 80	181 80
George E. Greene	Asst. engineer	14	5 00	70 00	....	70 00
H. K, Bishop	Leveler	17	5 00	85 00	....	85 00
R. T. Webster	Chainman	27¾	3 50	97 13	1 50	98 63
James S. Cook	Chainman	20	3 50	70 00	....	70 00
R. B. McDonald	Chainman	17	2 50	42 50	....	42 50
						$591 33
Incidental expenses.						
Postage						04
Total						$591 37

Extraordinary Repairs—South Clinton Street Bridge, Rochester.

(Chapter 339, Laws of 1897; Chapter 477, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	1	$250 per mo.	$9 61	....	$9 61
C. R. Neher	Resident engineer	2½	200 per mo.	18 50	....	18 50
M. W. Wilbur	First asst. engineer	11	$6 00	66 00	....	66 00
C. F. Middlebrook, Jr	Asst. engineer	77	5 00	385 00	50	385 50
J. B. Barrett	Leveler	2	4 50	9 00	....	9 00
T. J. Morrison	Leveler	¼	4 50	1 13	....	1 13
H. G. McKelvey	Draughtsman	2¾	4 00	11 00	....	11 00
Isaac O Cole	Rodman	2	3 50	7 00	....	7 00
R. T. Webster	Rodman	20¾	3 50	72 62	35	72 97
R. T. Webster	Chainman	34	3 50	119 00	....	119 00
James S. Cook	Chainman	2	3 50	7 00	....	7 00
Tracy B. Smith	Chainman	2	2 50	5 00	$3 75	8 75
						$715 46
Incidental expenses.						
Stowell and Cunningham, of Albany, for inspection					$200 80	
Postage					12	
						200 92
Total						$916 38

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—South Fitzhugh Street Bridge, Rochester.

(Chapter 82, Laws 1897; Chapter 606, Laws of 1898, and Chapter 477, Laws of 1899.)

NAME.	Rank.	Number of days	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	1	$250 per mo.	$9 62	....	$9 62
C. R. Neher	Resident engineer	3½	200 per mo.	23 70	....	23 70
M. W. Wilbur	First asst. engineer	6	$6 00	36 00	....	36 00
C. T. Middlebrook, Jr.	Assistant engineer	90¼	5 00	451 25	$0 15	451 40
T. J. Morrison	Leveler	26	4 50	117 00	....	117 00
J. B. Barrett	Leveler	10	4 50	45 00	....	45 00
H. G. McKelvey	Draughtsman	6	4 00	24 00	....	24 00
Philip H. Dater	Draughtsman	7	5 00	35 00	....	35 00
R. T. Webster	Rodman	37½	3 50	131 24	40	131 64
R. T. Webster	Chainman	43	3 50	150 50	....	150 50
James S. Coon	Chainman	6	3 50	21 00	....	21 00
						$1,044 86

Incidental expenses.

Stowell & Cunningham, for inspection	$183 10	
Postage	4	
Labor	52 00	
Stationery	7 50	
		242 64
Total		$1,287 50

Extraordinary Repairs—South Avenue Bridge, Brighton.

(Chapter 618, Laws of 1898.)

NAME.	Rank.	Number of days	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	½	$250 per mo.	$4 81	$5 27	$10 08
C. T. Middlebrook, Jr	Assistant engineer	2	$5 00	10 00	....	10 00
Thos. J. Morrison	Leveler	5	4 50	22 50	1 50	24 00
H. K. Bishop	Leveler	1	5 00	5 00	....	5 00
H. G. McKelvey	Draughtsman	1	4 00	4 00	....	4 00
R. T. Webster	Rodman	2¾	3 50	9 62	....	9 62
Isaac O. Cole	Rodman	2	3 50	7 00	....	7 00
Tracy B. Smith	Chainman	1	2 50	2 50	....	2 50
						$72 20

Incidental expenses.

Printing	$52 61	
Telegraph	26	
		53 87
Total		$125 07

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—" New Home Bridge."

(Chapter 630, Laws 1898)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
C. R. Neher	Resident engineer	½	$200 per mo.	$1 92	....	$1 92
						$1 92
Incidental expenses.						
Rochester Bridge and Iron Works, labor and materials, preparing plans for superstructure					$153 75	
Printing					36 47	
						190 22
Total						$192 14

Extraordinary Repairs—Erie Street Bridge, Buffalo.

(Chapter 611, Laws 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	1	$250 per mo	$9 62	$4 56	$14 18
C. R. Neher	Resident engineer	2½	200 per mo.	16 96	....	16 96
C. T. Middlebrook	Asst. engineer	14½	$5 00	72 50	3 26	75 76
T. J. Morrison	Leveler	27	4 50	121 50	....	121 50
J. B Barrett	Leveler	17½	4 50	78 75	2 45	81 20
John K. Lloyd	Draughtsman	27½	4 50	123 75	....	123 75
H. G. McKelvey	Draughtsman	19½	4 00	78 00	....	78 00
Philip H. Dater	Draughtsman	20	5 00	100 00	....	100 00
R. T. Webster	Rodman	11	3 50	38 50	....	38 50
Isaac O. Cole	Rodman	9	3 50	31 50	....	31 50
Frank Kromer	Chainman	2	3 00	6 00	1 50	7 50
Lewis G Fisher	Chainman	6	2 50	15 00	....	15 00
Alfred Mirick	Chainman	7	2 50	17 50	....	17 50
						$721 35
Incidental expenses.						
Stowell and Cunningham, of Albany, for inspection of materials					$508 89	
Labor					62 00	
Telephone					10	
Printing					16 10	
						587 09
Total						$1,308 44

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Hamilton Street Bridge, Buffalo.

(Chapter 568, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W. Wilbur	First asst. engineer	20	$6 00	$120 00	$27 67	$147 67
C. T. Middlebrook, Jr.	Asst. engineer	11	5 00	55 00	9 77	64 77
R. T. Webster	Chainman	11	3 50	38 50	....	38 50
						$250 94
Incidental expenses.						
Stowell and Cunningham of Albany					$27 48	
Telegraph					26	
Postage					47	
						28 21
Total						$279 15

Extraordinary Repairs—Exchange Street Bridge, Rochester.

(Chapter 514, Laws of 1895; Chapter 572 and 791, Laws of 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W. Wilbur	First asst. engineer	15	$6 00	$78 00	....	$78 00
C. T. Middlebrook	Asst. engineer	14	5 00	70 00	....	70 00
Thos. J. Morrison	Leveler	25	4 50	112 50	....	112 50
H. G. McKelvey	Draughtsman	12	4 00	48 00	....	48 00
F. D. Haak	Chainman	24	5 00	120 00	....	120 00
R. T. Webster	Chainman	34	3 50	119 00	....	119 00
						$547 50
Incidental expenses.						
Labor					$58 50	
Postage					08	
						58 58
Total						$606 08

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Main Street Bridge, Pittsford.

(Chapter 504, Laws 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. T. Middlebrook, Jr...	Assistant engineer...	1¾	$5 00	$8 75	....	$8 75
W. L. Curtis	Assistant engineer...	12	5 00	60 00	$2 46	62 46
F. L. Hurlbut............	Rodman	1	3 50	3 50	1 32	4 82
						$76 03
Incidental expenses.						
Labor					$3 00	
Rochester iron works for plans and inspection					225 88	
Printing..					26 37	
						254 25
Total						$330 28

Extraordinary Repairs—Ferry Street Bridge, Buffalo.

(Chapter 118, Laws 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. T. Middlebrook, Jr...	Assistant engineer...	¼	$5 00	$1 25	$1 05	$2 30

Extraordinary Repairs—Chapel Street Bridge, Lockport.

(Chapter 573, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. T. Middlebrook, Jr ...	Assistant engineer ..	2¼	$5 00	$11 25	$5 36	$16 61
H. G. McKelvey.........	Draftsman	6	4 00	24 00	....	24 00
R. T. Webster..........	Rodman	2	3 50	7 00	4 99	11 99
Lewis G. Fisher	Chainman	5	2 50	12 50	5 14	17 64
Total	....	...	....	....	....	$70 24

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs — Protecting Unfinished Work under General Improvement.

(Chapter 506, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W. Wilbur	First asst. engineer	7	$6 00	$12 00	$13 12	$55 12
W. L. Curtis	Assistant engineer	14	5 00	70 00	....	70 00
Geo. E Greene	Assistant engineer	12	5 00	60 00	....	60 00
Geo. J. Lord	Leveler	79	4 50	355 50	....	355 50
J. B. Barrett	Leveler	48	4 50	216 00	....	216 00
E. A. Sommer	Leveler	27	5 00	135 00	....	135 00
Thos. J. Morrison	Leveler	10	4 50	45 00	....	45 00
D. D. Waldo	Leveler	5	5 00	25 00	....	25 00
F. L. Hurlbut	Rodman	14	3 50	49 00	3 89	52 89
F. D. Haak	Chainman	2	5 00	10 00	....	10 00
James S. Cook	Chainman	15	3 50	52 50	....	52 50
H. H. Albright	Chainman	10	2 50	25 00	....	25 00
F. H. Lomax	Chainman	7	2 50	17 50	....	17 50
						$1,119 51
Incidental expenses.						
Postage					$0 65	
Telegraph					26	
Livery					63 00	
Miscellaneous					8 75	
						72 66
Total						$1,192 17

Extraordinary Repairs—Erie Canal Enlargement.

(Chapter 79, Laws 1895; Chapter 794, Laws 1896; Chapters 43 and 569, Laws 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neber	Resident engineer	....	....	....	$7 46	$7 46
M. W. Wilbur	First ass't engineer	2	$6 00	$12 00	9 00	27 00
George E. Greene	Assistant engineer	7	5 00	35 00	....	35 00
Garrett O. House	Assistant engineer	43	5 00	215 00	12 44	227 44
W. L Curtis	Assistant engineer	25	5 00	125 00	....	125 00
E. A. Sommer	Leveler	21	5 00	105 00	....	105 00
D. D. Waldo	Leveler	26	5 00	130 00	7 28	137 28
H. K. Bishop	Leveler	2	5 00	10 00	....	10 00
T J. Morrison	Leveler	13	4 50	58 50	....	58 50
H. G. McKelvey	Draughtsman	18	4 00	72 00	....	72 00
Isaac O. Cole	Rodman	33	3 50	115 50	....	115 50
F. W. Hamilton	Rodman	27	3 50	94 50	....	94 50
James S. Cook	Chainman	9	3 50	31 50	....	31 50
Tracy B. Smith	Chainman	2	2 50	5 00	....	5 00
Dan. D. Mead	Chainman	4	2 50	10 00	....	10 00
F. H. Lomax	Chainman	10	2 50	25 00	1 38	26 38
						$1,081 56
Incidental expenses.						
Rent					$125 01	
Telegraph and telephone					1 65	
Labor					18 00	
Fuel and light					3 00	
Miscellaneous					1 00	
						148 66
Total						$1,230 22

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Enlarging Spillway, Cuba Reservoir.

(Chapter 607, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	....	....	....	$13 50	$13 50
M. W. Wilbur	First asst. engineer	8	$6 00	$48 00	31 00	79 00
F. D. Haak	Chainman	2	5 00	10 00	....	10 00
R. T. Webster	Chainman	7	3 50	24 50	....	24 50
						$127 00
Incidental expenses.						
Telegraph						26
Total						$127 26

Extraordinary Repairs—Glen Creek Improvement, Watkins.

(Chapter 624, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	1	$250 per. mo.	$9 61	$3 71	$13 32
George E. Greene	Assistant engineer	3	$5 00	15 00	12 62	27 62
T. J. Morrison	Leveler	16½	4 50	74 25	7 04	81 29
						$122 23
Incidental expenses.						
Labor					$2 00	
Miscellaneous					23 18	
						25 18
Total						$147 41

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Montour Falls, Drainage of Chemung Canal.

(Chap. 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	1½	$200 per mo	$11 55	$4 36	$15 91
Garrett O. House	Assistant engineer	7	$5 00	35 00	4 29	39 29
E. V. R. Payne	Leveler	8	4 50	36 00	4 86	40 86
F. W. Gerstner	Chainman	8	2 50	20 00	4 86	24 86
Tracy B. Smith	Chainman	8	2 50	20 00	4 26	24 26
						$145 18
Incidental expenses.						
Telegraph					$1 52	
Miscellaneous					2 92	
						4 44
Total						$149 62

Extraordinary Repairs—Drainage Levels at Brighton.

(Chap. 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	7	$200 per mo.	$53 61	$1 80	$55 41
M. W. Wilbur	First ass't engineer	¾	$6 00	4 50	....	4 50
J. B. Barrett	Leveler	1	4 50	4 50	20	4 70
Philip H. Dater	Draughtsman	1	5 00	5 00	....	5 00
H. G McKelvey	Draughtsman	1¼	4 00	5 00	....	5 00
F. W Searls	Chainman	4½	2 50	11 25	95	12 20
Alfred S. Mirick	Chainman	1½	2 50	8 75	55	4 30
						$91 11

Extraordinary Repairs—Culvert No. 31, East of Pittsford.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	6	$250 per mo.	$56 34	$2 53	$58 87
C. R. Neher	Resident engineer	½	200 per mo.	3 70	41	4 11
Garrett O. House	Assistant engineer	1	$5 00	5 00	92	5 92
John K. Lloyd	Draughtsman	1½	4 50	6 75	....	6 75
Philip H Dater	Draughtsman	2	5 00	10 00	....	10 00
H. G. McKelvey	Draughtsman	½	4 00	2 00	....	2 00
R. T. Webster	Rodman	2¼	3 50	7 87	....	7 87
F. V. Searls	Chainman	1	2 50	2 50	92	3 42
						$98 94

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Brockport Culvert, No. 59.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	½	$250 per mo.	$4 81	$1 78	$6 59
C. R. Neher	Resident engineer	½	200 per mo.	3 85	1 16	5 01
D. D. Waldo	Leveler	4¼	$4 50	19 13	5 51	24 64
D. S. Hallenbeck	Boatman	3	3 00	9 00	4 48	13 48
F. V. Searls	Chainman	2	2 50	5 00	2 53	7 53
						$57 25

Incidental expenses.

Livery	$6 00	
Telegraph	60	
Miscellaneous	1 50	
		8 10
Total		$65 35

Extraordinary Repairs—Brockville Waste Weir.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	½	$250 per mo.	$4 81		$4 81
C. R. Neher	Resident engineer	1	200 per mo.	7 55	$1 70	9 25
D. D. Waldo	Leveler	2¼	$4 50	10 12	4 99	15 11
D. S. Hallenbeck	Boatman	2	3 00	6 00	3 53	9 53
F. V. Searls	Chainman	1	2 50	2 50	1 91	4 41
						$43 11

Incidental expenses.

Telegraph	$0 60	
Miscellaneous	62	
		1 22
Total		$44 33

Extraordinary Repairs—South St. Paul Street Wall, Rochester.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	8	$200 per mo.	$61 31		$61 31
H. G. McKelvey	Draughtsman	3½	$4 00	14 00		14 00
John B. Stobo	Chainman	1	2 50	2 50	$1 25	3 75
						$79 06

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Jackson's Bridge, No. 141.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. G. McKelvey	Draughtsman	4¾	$4 00	$19 00	....	$19 00

Extraordinary Repairs—Beal's Bridge, No. 136.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. B. Barrett	Leveler	2	$4 50	$9 00	....	$9 00
John K. Lloyd	Draughtsman	8	4 50	36 00	....	36 00
H. G. McKelvey.........	Draughtsman	1	4 00	4 00	....	4 00
						$49 00

Extraordinary Repairs—Elk Street Bridge Wall, Buffalo.

(Chapter 208, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
H. G. McKelvey..........	Draughtsman	3½	$4 00	$14 00	....	$14 00
R. T. Webster............	Rodman	½	3 50	1 75	....	1 75
						$15 75

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Delaware Street Culvert, Tonawanda.

(Chapter 632, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	2	$250 per mo.	$18 55	$5 14	$23 69
C R. Neher	Resident engineer	1¼	200 per mo.	9 83	4 48	13 81
D. D. Waldo	Leveler	16	$4 50	72 00	20 14	92 14
T J. Morrison	Leveler	½	4 50	2 25	....	2 25
Lewis G. Fisher	Chainman	32	2 50	80 00	1 73	81 73
F. V. Searls	Chainman	2	2 50	5 00	4 99	9 99
D. S. Hallenbeck	Boatman	3	3 00	9 00	4 46	13 46
						$237 07
Incidental expenses.						
Telegraph					$2 97	
Miscellaneous					1 67	
Livery					2 50	
Postage					27	
Printing					10 39	
						17 80
Total						$254 87

Extraordinary Repairs—Eighteen-Mile Creek Improvement.

(Chapter 609, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	1¼	$250 per mo.	$12 02	$5 00	$17 02
C. R. Neher	Resident engineer	½	200 per mo.	3 85	4 32	8 17
						$25 19
Incidental expenses.						
Labor					$4 00	
Miscellaneous					76	
						4 76
Total						$29 95

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Improvement Bull Creek, East Branch.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	¼	$200 per mo.	$1 92	....	$1 92

Extraordinary Repairs—Bridge at Medina over Canal Feeder.

(Chapter 606, Laws of 1898, and Chapter 569, Laws of 1899)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
John K. Lloyd	Draughtsman	2	$4 50	$9 00	....	$9 00
F. V. Searls	Chainman	1	2 50	2 50	$2 07	4 57
D. S. Hallenbeck	Boatman	1	3 00	3 00	1 82	4 82
						$18 39

Extraordinray Repairs—Mud Creek Improvement.

(Chapter 572, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	2	$250 per mo.	$17 86	$5 28	$23 14
C. R. Neher	Resident engineer	2	200 per mo	15 11	5 83	20 94
E. V. R. Payne	Leveler	52	$4 50	234 00	15 38	249 38
F. W. Gerstner	Chainman	52	2 50	130 00	8 02	138 02
Alfred S. Mirick	Chainman	16	2 50	40 00	6 33	46 33
Tracy B. Smith	Chainman	32	2 50	80 00	6 78	86 78
						$561 59

Incidental expenses.

Labor	$133 00	
Postage	53	
Telegraph	30	
Livery	26 25	
Miscellaneous	14 91	
		174 99
Total		$736 58

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Improving and Deepening Erie Basin.

(Chapter 635, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. L Little	Division engineer	31	$250 per mo.	$250 00	$23 57	$273 57
A. J. Rockwood	Division engineer	3	250 per mo.	28 15	13 27	41 42
C. R. Neher	Resident engineer	2¼	200 per mo.	16 85	11 50	28 35
M. W. Wilbur	First asst. engineer	1	$6 00	6 00	....	6 00
D. D. Waldo	Leveler	2	5 00	10 00	5 64	15 64
D. D. Waldo	Leveler	58	4 50	261 00	63 47	324 47
J. B. Barrett	Leveler	10	2 50	25 00	13 97	38 97
J. B. Barrett	Leveler	16	4 50	72 00	9 81	81 81
T. J. Morrison	Leveler	5	4 50	22 50	....	22 50
R. T. Webster	Chainman	22¾	3 50	79 63	22.85	101 98
F. V. Searls	Chainman	4	2 50	10 00	5 56	15 56
Walter Dubey	Chainman	7	2 25	15 75	....	15 75
D. S. Hallenbeck	Boatman	52	3 00	156 00	1 67	157 67
						$1,123 69

Incidental expenses.

Labor	$104 05	
Rent	7 50	
Telegraph and telephone	8 13	
Postage	1 50	
Miscellaneous	64 33	
		185 51
Total		$1,309 20

Extraordinary Repairs—Culverts, Nos. 42, 43, 45, and 56.

(Chapter 566, Laws 1897.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	4	$200 per mo.	$27 40	$4 88	$32 28
M. W. Wilbur	First asst. engineer	69	6 00	414 00	57 16	471 16
C. T. Middlebrook, Jr.	Assistant engineer	17½	5 00	87 50	....	87 50
T. J. Morrison	Leveler	9	4 50	40 50	....	40 50
J. B. Barrett	Leveler	4	4 50	18 00	5 28	23 28
R T. Webster	Chainman	10	3 50	35 00	....	35 00
James S. Cook	Chainman	3	3 50	10 50	3 34	13 84
						$703 56

Incidental expenses.

Livery	$21 50	
Binding books	16 00	
Postage	42	
		37 92
Total		$741 48

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Extraordinary Repairs—Survey for Court of Claims.

(Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	3	$250 per mo.	$28 85	$5 10	$33 95
C. R. Neher	Resident engineer	36¾	200 per mo.	281 26	38 41	319 67
M. W. Wilbur	First asst. engineer	4	$6 00	24 00	5 81	29 81
Garrett O. House	Assistant engineer	33	5 00	165 00	22	165 22
Foster B. Morse	Assistant engineer	53	5 00	265 00	7 18	272 18
D. D. Waldo	Leveler	54	4 50	243 00	18 52	261 52
T. J. Morrison	Leveler	15	4 50	67 50	....	67 50
E. A. Sommer	Leveler	15	4 50	67 50	....	67 50
J. B. Barrett	Leveler	3	4 50	13 50	90	14 40
John K. Lloyd	Draughtsman	10¼	4 50	46 13	....	46 13
R. T. Webster	Rodman	7	3 50	24 50	7 46	31 96
F. W. Hamilton	Rodman	6	3 50	21 00	....	21 00
Isaac O. Cole	Rodman	37	3 50	129 50	7 05	136 55
F. W. Gorstner	Chainman	20	2 50	50 00	....	50 00
R. W. Swanton	Chainman	9	2 50	22 50	....	22 50
F. V. Searls	Chainman	24¼	2 50	60 63	....	60 63
Lewis G. Fisher	Chainman	9	2 50	22 50	2 80	25 30
Frank Kromer	Chainman	28	3 00	84 00	4 75	88 75
						$1,714 57
Incidental expenses.						
Livery					$156 50	
Labor					168 55	
Telegraph					2 94	
Miscellaneous					33 82	
						361 81
Total						$2,076 38

General Fund—Allegany Indian Reservation, Highway.

(Chapter 790, Laws of 1897, and Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher	Resident engineer	1⅔	$200 per mo.	$11 11	$62 93	$74 04
M. W. Wilbur	First asst. engineer	15	6 00	90 00	38 50	128 50
T. J. Morrison	Leveler	10	4 50	45 00	....	45 00
D. D. Waldo	Leveler	12	5 00	60 00	....	60 00
J. B Barrett	Leveler	7	4 50	31 50	....	31 50
F. D. Haak	Chainman	14	5 00	70 00	....	70 00
R. F. Webster	Chainman	3	3 50	10 50	....	10 50
						$419 54
Incidental expenses.						
Telegraph					$0 91	
						91
Total						$420 45

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

General Fund—Cattaragus Indian Reservation, Highway.

(Chapter 790, Laws of 1897, and Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
C. R. Neher	Resident engineer	½	$200 per mo.	$3 71	$3 13	$6 84
T. J. Morris.n	Leveler	9	$1 50	40 50	....	40 50
F. D. Haak	Chainman	1	5 00	5 00	....	5 00
						$52 34

General Fund—Tonawanda Indian Reservation Highways.

(Chapter 790, Laws of 1897; Chapter 606, Laws of 1898; Chapter 210, Laws of 1899)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
A. J. Rockwood	Division engineer	2	$250 per mo.	$19 24	$3 28	$22 52
C. R. Neher	Resident engineer	½	200 per mo.	3 71	1 62	5 33
D. D. Waldo	Leveler	2	$5 00	10 00	7 28	17 28
D. D. Waldo	Leveler	8½	4 50	88 25	1 82	40 07
John K. Lloyd	Draughtsman	10	4 50	45 00	....	45 00
R. T. Webster	Rodman	3	3 50	10 50	....	10 50
F. W. Searls	Chainman	7	2 50	17 50	10 63	28 13
D. S. Hallenbeck	Boatman	7	3 00	21 00	11 07	32 07
						$200 90

Incidental expenses.

Telegraph	95	
Livery	$28 00	
		28 95
Total		$229 85

General Fund—Cattaragus Indian Reservation, Repairing Road and Bridge at Brant.

(Chapter 606, Laws of 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
M. W Wilbur	First ass't engineer	5	$6 00	$30 00	....	$30 00
D. D. Waldo	Leveler	6	5 00	30 00	....	30 00
						$60 00

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

General Fund—Clear Creek Bridge, Cattaraugus Indian Reservation.

(Chap. 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Total.
C. T. Middlebrook, Jr...	Assistant engineer...	½	$5 00	$2 50	$1 87	$4 37

General Fund—Newtown Creek Improvement.

(Chap. 919, Laws of 1896; chap. 791, Laws of 1897; chap. 607, Laws of 1898)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel	Tota
A. J. Rockwood.........	Division engineer....	1½	$250 per mo.	$13 74	$2 44	$16 18
C. R. Neher...............	Resident engineer ...	5	200 per mo.	37 34	16 79	54 13
John R. Kaley............	First ass't engineer..	40	$6 00	240 00	12 81	252 81
Isaac O Cole	Rodman	2	3 50	7 00	6 18	13 18
Joseph W. Howe.........	Rodman	6	3 50	21 00	9 18	30 18
Lewis G. Fisher..........	Chainman	2	2 50	5 00	6 18	11 18
Frank Kromer............	Chainman	9	3 00	27 00	9 01	36 01
John B. Stobo	Chainman	26	2 50	65 00	....	65 00
						$178 67
Incidental expenses.						
Labor					$4 34	
Telegraph					7 51	
Miscellaneous					19 00	
						30 85
Total.........................						$509 52

General Fund—Watkins Harbor Improvement.

(Chapter 697, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. R. Neher...............	Resident engineer ...	½	$200 per mo.	$3 85	$4 37	$8 22
Garrett O. House........	Assistant engineer...	27	5 00	135 00	15 55	150 55
E V. R. Payne...........	Leveler	12	4 50	54 00	6 54	60 54
H. G. McKelvey.........	Draftsman	6	4 00	24 00	....	24 00
F. W. Gerstner..........	Chainman	13	2 50	32 50	8 54	41 04
Tracy B. Smith	Chainman	12½	2 50	31 25	8 29	39 54
John B. Stobo	Chainman	1	2 50	2 50	1 25	3 75
F. V. Searls	Chainman	1	2 50	2 50	....	2 50
Alfred S. Mirick.........	Chainman	2	2 50	5 00	....	5 00
						$335 14
Incidental expenses.						
Livery					$1 00	
Miscellaneous					33 37	
						34 37
Total						$369 51

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Improvement Public Highways—Monroe Avenue, East Avenue and Ridge Roads, Monroe County; White's Corners Plank Road, Erie County and Southport Road, Chemung County.

(Chapter 115, Laws 1898.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
C. W. Adams	State engineer	....	....	....	$48 16	$48 16
H. Roberts	Dept. State engineer.	....	....	....	32 84	32 84
J. L. Little	Division engineer	....	....	....	113 64	113 64
A. J. Rockwood	Division engineer	36	$250 per mo	$350 15	75 44	425 59
C. R Neher	Resident engineer	29½	200 per mo.	212 89	71 76	284 65
G. C. Diebl	County engineer	....	....	....	18 50	18 50
M. W. Wilbur	First asst. engineer	106¾	$6 00	640 50	48 13	688 63
George E Greene	Assistant engineer	165	5 00	825 00	93 85	917 85
W. L. Curtis	Assistant engineer	40	5 00	200 00	62 97	262 97
Garrett O. House	Assistant engineer	37	5 00	185 00	16 44	201 44
Thomas J. Morrison	Leveler	23¾	4 50	106 87	....	106 87
J. B. Barrett	Leveler	68½	4 50	308 25	20 17	828 42
E. A. Sommer	Leveler	30½	4 50	137 25	17 90	155 15
J. K. Lloyd	Draughtsman	18½	4 50	83 25	....	83 25
H. G. McKelvey	Draughtsman	18	4 00	72 00	....	72 00
F. W. Hamilton	Rodman	116	3 50	406 00	24 34	430 34
R. T. Webster	Rodman	6¾	3 50	23 64	2 35	25 99
Isaac O Cole	Rodman	3	3 50	10 50	1 05	11 55
F. L. Hurlbut	Rodman	28	3 50	98 00	13 30	111 30
Walter Dubey	Chainman	161	3 50	563 50	42 91	606 41
Walter Dubey	Chainman	20	2 25	45 00	....	45 00
Dan. D. Mead	Chainman	39	2 50	97 50	33 81	131 31
F. H. Lomax	Chainman	61	2 50	152 50	12 68	165 18
R. B. McDonald	Chainman	19	2 50	47 50	7 06	54 56
James S. Cook	Chainman	8	3 50	28 00	....	28 00
Tracy B. Smith	Chainman	52½	2 50	131 25	24 74	155 99
Alfred S. Mirick	Chainman	36	2 50	90 00	13 70	103 70
F. V. Searl	Chainman	58¼	2 50	145 62	15 10	160 72
Frank Kromer	Chainman	7	3 00	21 00	7 80	28 80
John B. Stobo.	Chainman	2	2 50	5 00	4 34	9 34
D. S Hallenbeck	Boatman	37	3 00	111 00	1 00	112 00
						$5,920 15

Incidental expenses.

Labor	$542 68	
Postage	4 65	
Rent	85 00	
Telegraph	23 52	
Printing	8 74	
Livery	241 75	
Miscellaneous	124 49	
		1,025 78
Total		$6,945 93

STATEMENT SHOWING NAMES, RANK, ETC.—(*Continued*).

Ordinary Repairs.

(Chapter 485, Laws of 1897; Chapter 550, Laws of 1898, Chapter 569, Laws of 1899.)

NAME.	Rank.	Number of days.	Rate of compensation.	Salary.	Travel.	Total.
J. F. Little	Division engineer	101	$250 per mo.	$830 35	$111 75	$942 10
A. J. Rockwood	Division engineer	148½	250 per mo.	1,321 85	140 39	1,462 24
C. R Neher	Resident engineer	281½	200 per mo.	1,561 62	165 84	1,727 46
M. W. Wilbur	First asst. engineer	56	$6 00	336 00	82 77	418 77
John R. Kaley	First asst. engineer	2	6 00	12 00	16 70	28 70
C. T. Middlebrook, Jr.	Assistant engineer	32	5 00	160 00	41 72	201 72
George E. Greene	Assistant engineer	115	5 00	575 00	16 32	591 32
W. L. Curtis	Assistant engineer	66	5 00	330 00	....	330 00
D. D. Waldo	Leveler	104	5 00	520 00	56 78	576 78
D. D. Waldo	Leveler	17	4 50	76 50	6 34	82 84
Thomas J. Morrison	Leveler	119½	4 50	537 75	....	537 75
H. K. Bishop	Leveler	24	5 00	120 00	37 08	157 08
E. A. Sommer	Leveler	23	5 00	115 00	36 22	151 22
E. A. Sommer	Leveler	5½	4 50	24 75	5 88	30 63
George J. Lord	Leveler	4	4 50	18 00	....	18 00
J. B. Barrett	Leveler	14	2 50	35 00	2 84	37 84
J. B. Barrett	Leveler	37	4 50	166 50	4 56	171 06
John K. Lloyd	Draughtsman	16¼	4 50	73 12	....	73 12
H. G. McKelvey	Draughtsman	5	4 00	20 00	....	20 00
Isaac O. Cole	Rodman	9	3 50	31 50	10 94	42 44
F. W. Hamilton	Rodman	1	3 50	3 50	35	3 85
R. T. Webster	Rodman	1	3 50	3 50	5 11	8 61
Fred. D. Haak	Chainman	89	5 00	445 00	12 04	457 04
Walter Dubey	Chainman	11	3 50	38 50	....	38 50
R. T. Webster	Chainman	33	3 50	115 50	2 01	117 51
James S. Cook	Chainman	20	3 50	70 00	26 80	96 80
Tracy B. Smith	Chainman	7	2 50	17 50	7 90	25 40
Alfred S. Mirick	Chainman	8½	2 50	21 25	....	21 25
Henry Geck	Chainman	43	2 50	107 50	....	107 50
R. B. McDonald	Chainman	26	2 50	65 00	....	65 00
F. H. Lornax	Chainman	4	2 50	10 00	....	10 00
H. H. Albright	Chainman	4	2 50	10 00	....	10 00
C. G. Harger, Jr	Confidential clerk	156	5 00	780 00	9 00	789 00
Anna M. Lorscheider	Stenographer	132	2 25	297 00	....	297 00
						$9,648 53

Incidental expenses.

Livery	$42 25	
Rent	558 33	
Printing and stationery	483 43	
Telegraph and telephone	302 70	
Postage	88 03	
Fuel and light	28 49	
Labor	375 42	
Miscellaneous	927 94	
		2,806 59
Total		$12,455 12

Summary of engineering expenses upon the Western Division, New York State Canals, for the fiscal year ending September 30, 1899.

	Authorized by		
	Chapter.	Laws.	Amount.
Extraordinary Repairs.			
Monroe avenue bridge, Rochester	207 607 477	1897 1898 1899	$591 37
South Clinton street bridge, Rochester	339 477	1897 1899	916 38
South Fitshugh street bridge, Rochester	32 606 477	1897 1898 1899	1,287 50
South avenue bridge, Brighton	618	1898	125 07
"New Home Bridge"	630	1898	192 14
Erie street bridge, Buffalo	611	1898	1,308 44
Hamilton street bridge, Buffalo	568	1897	279 15
Exchange street bridge, Rochester	514 572 791	1895 1897 1897	606 08
Main street bridge, Pittsford	504	1898	330 28
Ferry street bridge, Buffalo	618	1899	2 30
Chapel street bridge, Lockport	573	1899	70 24
Protecting unfinished work under general improvement	506	1898	1,192 17
Erie canal enlargement	79 794 43 569	1895 1896 1897 1897	1,230 22
Enlarging Spillway Cuba reservoir	607	1898	127 26
Glen Creek improvement, Watkins	624	1898	147 41
Montour Falls, Drainage of Chemung canal	569	1899	149 62
Drainage levels at Brighton	208	1899	91 11
Culvert No. 31, east of Pittsford	208	1899	98 94
Brockport culvert, No. 59	208	1899	65 35
Brockville waste weir	208	1899	44 33
South St. Paul street wall, Rochester	208	1899	79 06
Jackson bridge, No. 141	208	1899	19 00
Beals bridge, No. 136	208	1899	49 00
Elk street bridge wall, Buffalo	208	1899	15 75
Delaware street culvert, Tonawanda	633	1898	254 87
Eighteen Mile creek improvement	609	1898	29 95
Improvement of Bull creek, east bank	569	1899	1 92
Bridge at Medina, over canal feeder	606 569	1898 1899	18 39
Mud creek improvement	572	1899	739 58
Improving and deepening Erie basin	635	1898	1,309 20
Culverts Nos. 42, 43, 45 and 56	566	1897	741 48
Survey for Court of Claims	569	1899	2,076 38
General fund.			
Allegany Indian reservation, highways	790 569	1897 1899	420 45
Cattaragus Indian reservation, highways	790 569	1897 1899	52 34
Tonawanda Indian reservation, highways	790 606 210	1897 1898 1899	229 85
Cattaragus Indian reservation, repairing road and bridge at Brant.	606	1898	60 00
Cattaragus Indian reservation, Clear creek bridge	569	1899	4 37
Newtown creek improvement	949 791 607	1896 1897 1898	509 52
Watkins harbor improvement	697	1899	369 51
Improvement public highways.			
Monroe avenue, East avenue and Ridge roads, Monroe county White's Corners plank road, Erie county and Southport road, Chemung county	115	1898	6,945 93
Ordinary repairs	435 550 569	1897 1898 1899	12,455 12
			$85,237 03

ERRATA.

On page 380, instead of "20 per cent. added for screening," say "25 per cent. of the loose measurement added for screenings."

Publication of the bench-marks referred to on page 428 is deferred for rearrangement.

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